

JULY 1971/\$1

AIR FORCE

Published by the Air Force Association

MAGAZINE

THE ELECTRONIC AIR FORCE

- SYSTEMS
- SENSORS
- COMPUTERS

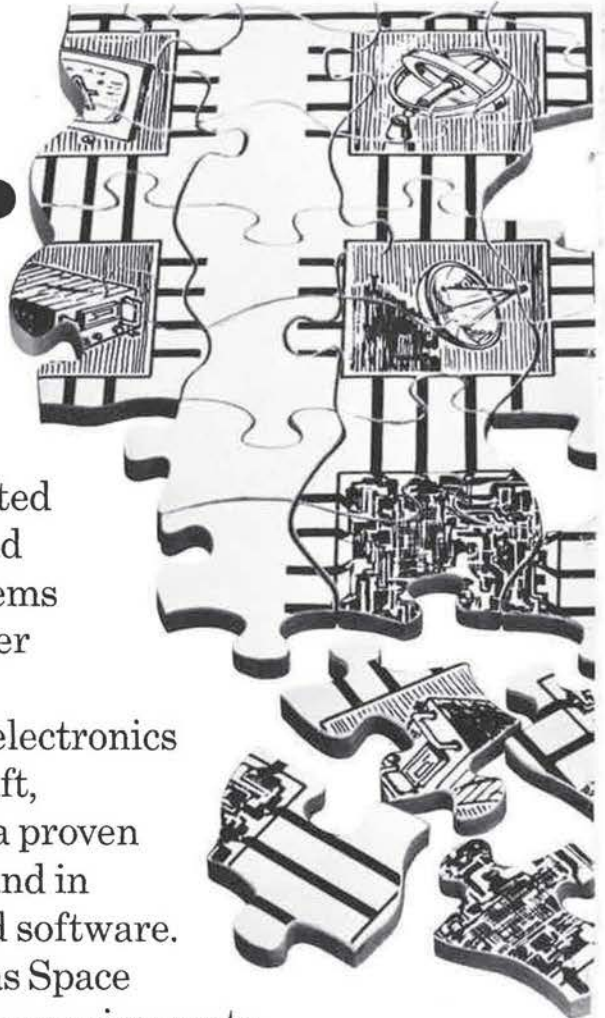
LOW COST SHUTTLE AVIONICS: TRW CAN PUT IT ALL TOGETHER.

As airborne electronics are called upon to satisfy a growing number of functions, the need for truly integrated avionics grows more acute. TRW has the demonstrated capability of identifying the right pieces and making them fit together with proven systems engineering concepts and with LSI and other advanced avionics technology.

TRW's broad background in airborne electronics has been demonstrated in numerous aircraft, space and missile applications. We possess a proven capability in avionics system engineering and in producing related subsystem hardware and software.

As a member of the McDonnell Douglas Space Shuttle team, TRW has been responsible for requirements analysis and definition of an integrated avionics system. In addition, we have provided detailed designs of the guidance and navigation, communication, power conversion and conditioning, instrumentation and data bus, and data management subsystems.

For more information about TRW avionics capabilities, contact Marketing Services, TRW Systems Group, One Space Park, Redondo Beach, California 90278.



TRW[®]

more computational power per pound than any computer ever built

UNIVAC 1832 Airborne Multiprocessor

*Meets the design
requirements of the
Advanced Airborne
Command Post
(AACP).*

*This advanced
multiprocessor
experience will be
applied to the B-1
Program.*

Just 380 pounds in 10.5 cubic feet. Which means you can stow it just about anywhere. A multiprocessor. So it handles a lot of mission requirements simultaneously. Modular. So you can buy a small system and add to its capabilities as yours expand. And tough enough to withstand any environment.

That, in a nutshell, is the UNIVAC® 1832. Two central processors. Two input/output controllers. Memory units. Power supplies. It will handle 1.5 million operations per second. Nothing its size can equal its out-



put. Or its high reliability and cost/effectiveness.

It even insures continuing operations in the unexpected event of computer hardware failures.

Software exists and the 1832 is fully compatible with the UNIVAC AN/UYPK-7 computer system. Find out how the 1832 can help you handle mission problems with its speed and capacity. Call or write: Univac, Defense Systems Division, Marketing Director, Avionics, Univac Park Box 3525, St. Paul, Minnesota 55101.

UNIVAC

First in real-time computer systems.

 SPERRY RAND



**We say our Associative
Air Traffic Controllers the
When we say it,**

Wayne Brubaker, our Digital Systems Marketing Manager and his team are proving this claim now for the Federal Aviation Administration with the STARAN IV Associative Array Processor installation at Knoxville, Tennessee. When Wayne says it —he means it.

Goodyear leads in both hardware and software for Associative Array Processors. Besides offering you a choice of either solid state or plated wire array modules, Goodyear has the only operational software and the most extensive background and capability in system analysis for Associative Array Processor application.

Air Force systems such as:

- ★ AWACS
- ★ SCK FLEX

Processors will give help they need at lowest cost. we mean it.



- ★ Advanced Airborne National Command Post
- ★ OTH Radar
- ★ AFCS Terminal Control

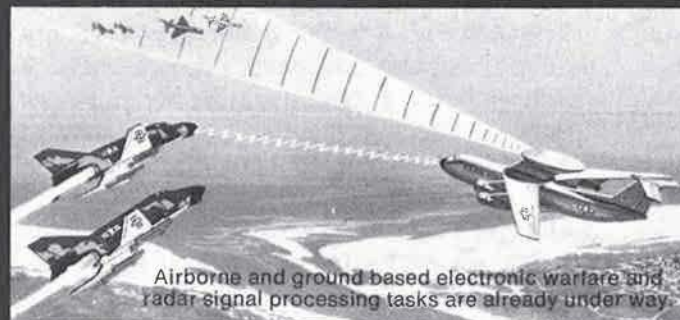
Benefit from Goodyear's experience with Associative Array Processors in an operational environment—and obtain greater performance and capacity at lowest cost.

In addition to air traffic control and the above systems, Goodyear Aerospace Associative Processors can provide significant benefits in other radar, electronic warfare, communications and data base management systems.

You can put this technology to work for you. Save money and improve your system performance. When we say it, we mean it.

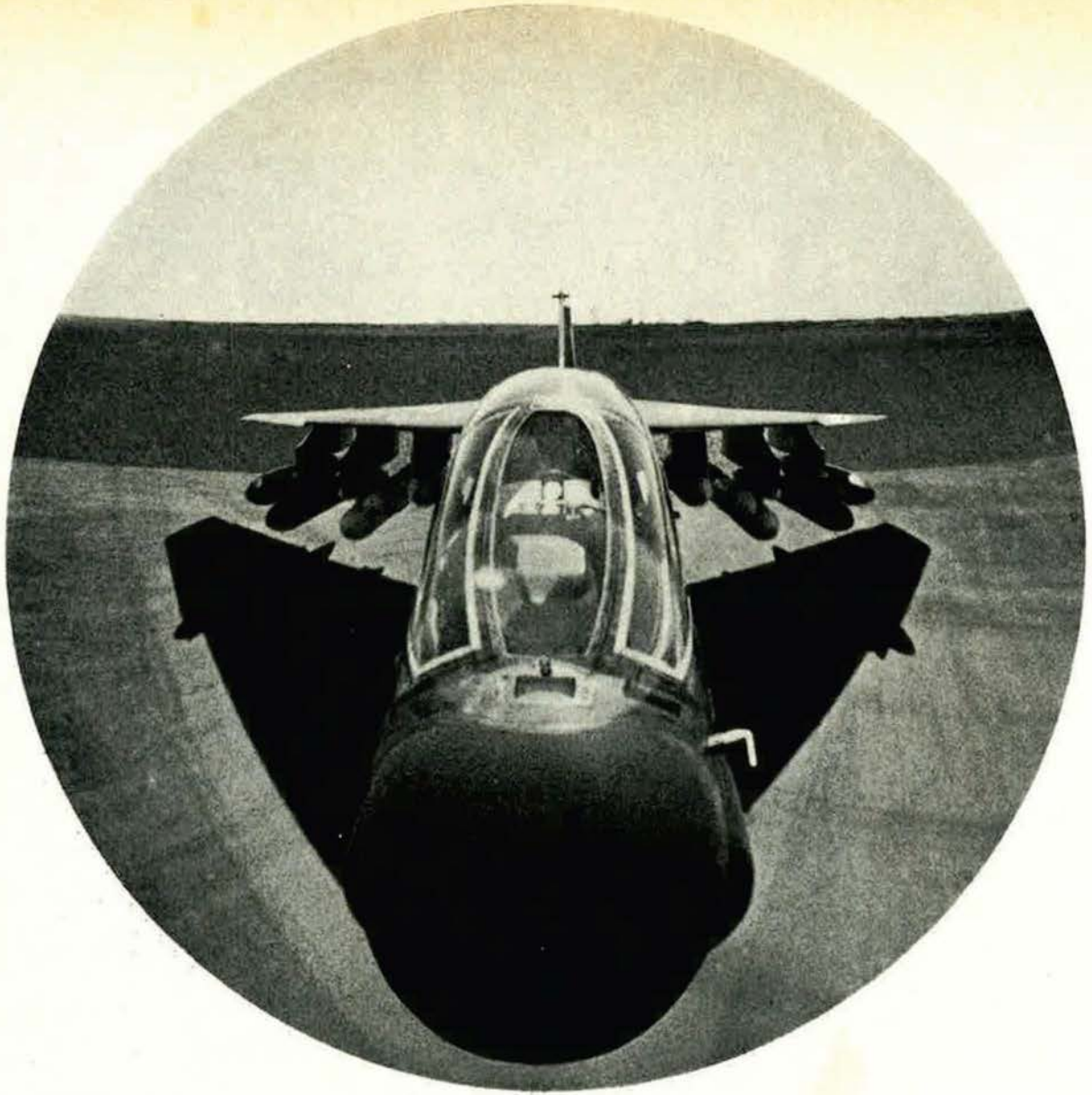
For information call Wayne (216) 794-3631. Or

write Goodyear Aerospace Corporation, Department 911VG, Akron, Ohio 44315.



Airborne and ground based electronic warfare and radar signal processing tasks are already under way.

GOODYEAR AEROSPACE



Today's A-7: A lot more airplane than anyone bargained for.

Its mission is close support and interdiction. Its accuracy is unprecedented.

The Air Force A-7D and Navy A-7E are equipped with an advanced avionics package which includes a central digital computer, an improved Doppler, inertial platform, forward looking radar, projected map display and an eye-level head-up display.

The A-7's systems are so skillfully integrated that it's an easy aircraft to fly. Programmed navigation aids and ordnance releases give the

pilot vital freedom to concentrate on his target and evasive maneuvers.

It can deliver up to 15,000 pounds of mixed ordnance with better than 10-mil accuracy. Destroying hard targets in one-third the number of sorties required with other available systems.

In service, pilots are discovering mission capabilities that weren't even written into the books. So while it's making pilots more versatile and accurate, they are making it a lot more airplane than anyone bargained for.



**VOUGHT
AERONAUTICS**

THIS MONTH

- 6 **There's Got To Be a Better Way** / An Editorial by John F. Loosbrock
- 12 **The Threat Fixes the Cost** / By Claude Witze
- 32 **USAF's Electronic Revolution** / By John L. Frisbee
- 37 **USAF's Electronic Future—Open-Ended** / By William Leavitt
- 42 **What's Happening in Electronics at ESD**
- 44 **Computers: The Military Decision-Makers' Top Tool**
By Edgar Ulsamer
- 50 **EIA—Serving the Electronics Industry** / By V. J. Adduci
- 51 **The Strategic Threat** / By Brig. Gen. Harry N. Cordes, USAF
- 56 **NATO's Northern Flank—Vital But Increasingly Vulnerable**
By Stefan Geisenheyner
- 62 **Operation Crossroads** / By Col. Kenneth L. Moll, USAF
- 70 **The Past Is Prologue . . . And a Lot of Fun!** / By William P. Schlitz
- 72 **AFLC's Golden Anniversary**
- 78 **23d Annual Arnold Air Society Conclave**

THIS MONTH'S COVER . . .

The background is an enlarged segment of a Fairchild Semiconductor 4100 Memory Board, packing some 160,000 electronic devices into each square inch and representing LSI, or large-scale integration, the key to advanced electronics. See the special section, starting on p. 32.



THE DEPARTMENTS

- 8 **Airmail**
- 12 **Airpower in the News**
- 16 **MIA/POW Action Report**
- 18 **Aerospace World**
- 25 **Index to Advertisers**
- 29 **Airman's Bookshelf**
- 73 **The Bulletin Board**
- 74 **Senior Staff Changes**
- 80 **AFA News**
- 87 **This Is AFA**
- 88 **There I Was**

Publisher: James H. Straubel

Editor and Assistant Publisher:
John F. Loosbrock

Managing Editor: Richard M. Skinner

Art Director: Philip E. Kromas

Associate Art Director: James W. Keaton

Production Manager: Mary Bixiones

Senior Editorial Assistants:

Peggy M. Crowl
Nellie M. Law

Editorial Assistants:

Catherine L. Bratz
Pearlie M. Draughn

Senior Editors:

John L. Frisbee, William Leavitt, Edgar Ulsamer, Claude Witze

News Editor:

William P. Schlitz

Regional Editors:

Stefan Geisenheyner, Editor for Europe
Sonnenberger Str. 15
D-6200 Wiesbaden, Germany
Telephone: (06121) 37 23 97
Irving Stone, West Coast Editor
10000 Santa Monica Blvd.
Los Angeles, Calif. 90067
Telephone: (213) 879-2447

Contributing Editors:

Maurice L. Lien, Patricia R. Muncy,
Don Steele

Advertising Director:

Charles E. Cruze
1750 Pennsylvania Ave., N.W.
Washington, D.C. 20006
Telephone: (202) 298-9123

Sales Representatives:

Douglas Andrews, New York (212) 687-3544
James G. Kane, Chicago (312) 296-5571
Harold L. Keeler, Los Angeles (213) 879-2447
Yoshi Yamamoto, Tokyo 535-6614

European Sales Director:

R. A. Ewin
20-23 Holborn
London EC1, England
Telephone: (01) 242-7484



Circulation audited by
Business Publications Audit

AIR FORCE Magazine (including **SPACE DIGEST**) is published monthly by the Air Force Association, Suite 400, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. Phone: (202) 298-9123. Second-class postage paid at Washington, D.C. Membership rate: \$10 per year (includes \$9 for one-year subscription). Subscription rate: \$10 per year; \$2 additional for foreign postage. Single copy \$1. Special issues (Spring and Fall Almanac Issues) \$2 each. Change of address requires four weeks' notice. Please include a recent mailing label. Publisher assumes no responsibility for unsolicited material. Trademark registered by Air Force Association. Copyright 1971 by Air Force Association. All rights reserved. Pan-American Copyright Convention.

There's Got To Be a Better Way

By John F. Loosbrock

EDITOR, AIR FORCE MAGAZINE

WELL, the New York Yankees are in next to last place in their division of the American League, the Green Bay Packers are rebuilding on the ruins of past glory, and the Boston Celtics are just another basketball team. The older order passeth. But the fate of the nation scarcely hangs in the balance because Vida Blue has replaced Whitey Ford as a household name. Somebody has to be second best, and sports lovers here in Washington have become inured to much worse than that.

What does take a lot of getting used to is the melancholy fact that after more than a quarter of a century of dominating the international aviation scene the United States is well on its way to becoming, if not an also-ran, just another contender for the trophies of the world's aviation markets.

For indicators, one only had to stroll the display line, watch the flying demonstrations, and eavesdrop at the chalets at the recently concluded Paris Air Show.

The bitterest pill, of course, was the lack of an American presence in the supersonic-transport competition, while the Soviet TU-144 and the Anglo-French Concorde were impressing customers, the press, the public, and me. But equally important was the dazzling array of commercial and military aviation products ebulliently displayed and demonstrated with New World hustle by Old World suppliers.

What began to come clear in Paris was something that has been niggling around uneasily in my mind for some months. For the United States to forge ahead once again, not only in aviation but in advanced technology generally, is going to require a good deal more than money. It's going to take new ways of looking at the problem, new ways of doing things. We are pricing ourselves out of the market, not only for what we hope to sell abroad, but even for what we would like to sell to ourselves.

There has got to be a better way. And, while I pretend to no special expertise in either economics or technology, I can also remember that it was a little child who cried out, "But the emperor has no clothes!" More than twenty-five years of observing and commenting on the Washington scene provide credentials of a sort.

My version, then, of "The emperor has no clothes" is: "We are being managed to death."

This is an oversimplification, of course, but what it means to me is that we are consistently putting more

and more people and money into the big end of the funnel to get a smaller and smaller trickle of useful output from the little end. This does not mean that the individuals involved are incompetent or that they are overpaid. It means, rather, that a higher and higher proportion of total effort goes into keeping track of what is being done and a smaller and smaller percentage goes into actual doing. The result is what I choose to call "middle-management featherbedding," and, in my judgment, it is a much greater threat to American productivity, and hence our world competitive position, than organized labor featherbedding ever could be.

Let's take the weapon system acquisition process. Over the years since the National Security Act of 1947 established the Department of Defense, the number of assistant secretaries and deputy assistant secretaries has multiplied. (I even saw a Pentagon sign the other day that identified Mr. So-and-so as "Principal Deputy Assistant Secretary" for someone or other.) These slots have begotten "opposite number" slots in the individual departments as well as a new bank of senior military positions. Now, if three companies are asked to bid on a new system, each prospective bidder sets up his own battalion of "opposite number" executives. But only one company gets the contract. You can see where it all leads. This is why prices go up. And the syndrome is pervasive in our society—it is not peculiar to the Pentagon or, indeed, to government.

Worst of all is the fact that unnecessary and duplicative activity finds its way into the gross national product. So, if the GNP keeps going up, we think we are doing better than we actually are. What we need instead is a different yardstick, an index of *gross national productivity*, which is quite a different thing. Nor need there be any surge in unemployment percentages as a result.

As previously noted, the vast majority of individuals now in essentially nonproductive jobs are capable and dedicated. But they are victims of the system. If the system were such that a higher proportion of human effort and money went into productivity, there would be more than enough money, and enough good people, left over to do all the things we now tell ourselves are necessary but which can't be accomplished because we don't have the money or the people.

Productivity is the answer, and if we can't figure out a way to get it, the next Paris Air Show will be a gloomy one indeed for the United States. ■

TACTICAL COMMAND-CONTROL

Use proven in
operational field exercises:

HEAVY BARE
BOLD SHOT/BRIMFIRE

and now
EXOTIC DANCER



TO MAINTAIN, DISPLAY, AND TRANSMIT

- AIRLIFT FRAG ORDERS
- MISSION SCHEDULES
- ARRIVAL/DEPARTURE/DEVIATION REPORTS
- MISSION SUMMARY
- HOURLY AIRLIFT SUMMARIES
- FIGHTER/RECCE/WEATHER STATUS
- COMPLETED MISSION RECORDS

THE BR-700 INFORMATION SYSTEM

. . . is a stand alone, off-line data information display system operating from its own local base . . . Since the BR-700 is a completely self-contained system, the local data base may be accessed, altered, and data refiled without software . . . The controller and the local storage is field expandable to service 16 operator stations . . . Off-line message composition and validation assure error-free transmissions . . . The BR-700 has provisions for communicating with printers, mag tape, modems, computers,

and other operator stations of the system . . . Bulk data transfers may be accomplished into and out of the BR-700 storage at high speed when communicating with a central data bank . . . For additional information contact the Bunker Ramo Marketing Department, Electronic Systems Division, 31717 La Tienda Drive, Westlake Village, California 91361.

**BUNKER
RAMO**

Thoughts for Our Times

Gentlemen: Sufficient to state, [John Loosbrock's May issue] editorial, "Fogbound on a Precipice," says the things that need repeating in such an effective manner that I would consider the editorial one of the best pieces of writing I have seen in many years. . . .

COL. FRED E. BAMBERGER, JR.,
USAFR
New York, N. Y.

Gentlemen: Rarely—just rarely—those of us in the craft of putting words to paper come across a piece of writing that we wish we could have written ourselves.

Such is the editorial in the May issue. It is a beautifully phrased expression of particularly apt thought for our times.

It is a striking testimonial also that the typographer recognized the necessity of taking his own craft out of the straight and narrow to accommodate it.

WILLIAM G. KEY
Washington, D. C.

Gentlemen: Your "Fogbound" editorial is great! It says some things that badly need saying, and you did an excellent job of saying them.

Congratulations on an exceptionally fine piece of writing . . . and let me add the same to Claude Witze for his recent efforts.

HAL GETTINGS
Orlando, Fla.

More on "Selling"

Gentlemen: I've followed with keen interest the controversy over "The Selling of the Pentagon," and side wholeheartedly with Claude Witze's analysis.

One point I've never seen expressed during all the condemnation and defense is simply: Efforts to win public support are legitimate—yea, indispensable—in a democratic society.

The citizen is asked to seek facts, weigh opinions, and vote. His judgment is based on opposing parochial viewpoints. Does he favor the SST; a jet airport; higher taxes for education; Vietnam pullout; new welfare proposals? Vital to his conclusions are the official proposals of his representatives in governmental positions as well as their opponents. The press demands those views, and rightly so, in order to help voters find both facts and opinions.

It all takes time and manpower. It is just as legitimate for the Pentagon to hire people to make official viewpoints available as it is for the public media to pay leg men and analysts to process them to the public.

As long as the public relations effort does not distort facts, use undue pressure, or become overbearing in the process of selling its wares, the cost is as legitimate as the democracy it serves.

BRIG. GEN. HAROLD W. BOWMAN,
USAF (RET.)
Jupiter, Fla.

Gentlemen: I have read your two lucid and penetrating articles on what CBS pretends is a serious documentary on the Pentagon's public information programs. What amazes me is that it took them seven months to turn out such a pitiful production. You could have shown them how to turn out a legitimate and necessary critique and analysis in seven days.

Fortunately, I had seen the first article prior to my going on the CBS "Perspective" show. Frankly, I did not conceive my role to be that of proponent for the Defense Department any more than that of opponent and critic of CBS.

Your two articles constitute a piece of work for which you may justly feel proud.

ARTHUR SYLVESTER
New York, N. Y.

• *Mr. Sylvester served as Assistant Secretary of Defense for Public Affairs from 1961 to 1967. For many years before that, he was Washington correspondent for the Newark Evening News.—THE EDITORS*

Avid Reader

Gentlemen: Although I rarely see printed in your "Airmail" letters from ladies, I could not let your twenty-fifth anniversary pass without sharing with you how much I have enjoyed AIR FORCE Magazine during my fifteen years as an Air Force wife.

Reared in a small Georgia town and with no family military ties, I entered marriage to my second lieutenant husband with little knowledge of the military or airpower. However, in that first year I decided to learn all I could about my husband's chosen career field.

It was my husband who introduced me to AIR FORCE Magazine and I

have been an avid reader from that day. I knew I was "hooked" on Air Force periodicals when I started scrambling through my husband's flight bag to see what I could find to read. SAC's *Combat Crew* became a favorite, but for in-depth reading your magazine has remained number one.

I can't say that I understand completely all the articles, especially the very technical ones, but I do read each issue cover to cover when time allows. Major Wallace is presently serving in Thailand and being both Mama and Papa to our three youngsters has limited my reading time.

I was particularly interested in Mr. Witze's April article concerning the TV documentary, "The Selling of the Pentagon." His article confirmed my suspicions that CBS had presented a grossly biased viewpoint. As a housewife, there is not a great deal I can do in protest of such programming, but I can turn the knob on my set to another channel. Three cheers for Mr. Witze and his determined pursuit of the facts.

In conclusion, I will say that many times I have been in conversation about the Air Force and had someone ask (including my husband), "Where did you learn that?"

I am always happy to reply, "In AIR FORCE Magazine."

MEDRA WALLACE (MRS. R. S.)
Bellevue, Neb.

VNAF Aircraft

Gentlemen: The article written by Mr. Kenneth Sams describing the progress of the Vietnamization program was, for the most part, very interesting and informative [April 1971 issue]. There were, however, some inaccuracies in Mr. Sams's observations regarding the fighter force. I recently served a tour of duty in Vietnam as an F-5 adviser to the Vietnamese Air Force so I can speak with some authority.

Mr. Sams alluded to a "problem" with dryness in the air-conditioning system. All jet aircraft air-conditioning systems, when operated in an area of high humidity, generate a fog in the cockpit similar to that emitted by an automobile air-conditioning system in a similar environment. The normal procedure for all jets in this environment is to turn up the heat on the system during takeoff and landing, which prevents fogging. This period is of short duration. . . .

Mr. Sams does not disclose the source of his information regarding the seat spacers and rudder pedal blocks required to adapt the cockpit and controls to the "average" Vietnamese pilot. His information is suspect, however, since I am well acquainted with all of the VNAF F-5 pilots, and none of them required or used such artificial aids.

Finally, Mr. Sams makes reference to the "more efficient A-37." Perhaps he should further elaborate on what he considers efficient. For example, the reaction time for the F-5 from takeoff to bombs on target is approximately one-half that of the A-37. Considering equal loads, the radius of action of the F-5 is greater than the A-37. The F-5 is equipped with two 20-mm cannon while the A-37 mounts a 7.62-mm Minigun. Last but not least, the F-5 possesses a fine air-to-air combat capability!

MAJ. D. F. CRANE,
USAF (RET.)
Los Angeles, Calif.

Seventh AF Historian

Gentlemen: In the April issue, Kenneth Sams, the author of "How the South Vietnamese Are Taking Over Their Own Air War," has been incorrectly identified as the "historian of the Seventh Air Force in Vietnam for many years." He may be more correctly identified as the Seventh Air Force Chief of Project CHECO (Contemporary Historical Examination of Current Operations). This project is conducted under the auspices of DCS/Operations, Headquarters Seventh Air Force. . . .

Mr. Sams must certainly be considered an authority on the air war due to his long association with Seventh Air Force. However, to give credit where it is due . . . recognition must be extended to Mr. C. R. Rowdybush, who has been, since January 1968, and continues to be, Command Historian for Seventh AF. . . .

MSGT. WILLIAM D. RICHERSON
NCOIC, Office of PACAF History
Hq. PACAF
Hickam AFB, Hawaii

• *AFCHO here tells us that Mr. Sams originally went to Vietnam as historian, but when CHECO started, he was named chief of that project. Col. John F. Loye is the current Chief, Project CHECO.*—THE EDITORS

Pearl Harbor Survivors

Gentlemen: December 7 of this year will mark the thirtieth anniversary of the infamous attack on Pearl Harbor and other military installations on the island of Oahu in 1941.

The Pearl Harbor Survivors Asso-

ciation is making an intensive effort this year to search out all survivors of that attack to invite them to become members of their select group.

Founded in 1958, the association experienced fantastic growth in the years following its founding and has members in almost all of the fifty states and also in foreign countries. There are now seventy-eight chapters chartered by the National Office, and the association continues to grow.

"Hawaiian Fun in '71" is the theme for the Thirtieth Anniversary-Convention-Reunion being held in Hawaii this year. Program arrangements have already been made for special travel groups, one group December 1-8, another December 6-13, and a third group December 1-15.

Interested survivors desiring more details, location of your nearest chapter, and a membership application should write to

JOHN H. SHARK
D. C. Chapter Chairman PHS
7205 Giles Place
Springfield, Va. 22150
Phone: (703) 451-2025

Department of Embarrassment

Gentlemen: This Separate Operating Agency of the US Air Force appreciates the opportunity provided by your Almanac issue to relate our command mission.

We did, however, note a discrepancy in the listing of our Commander's name and photo. In the photo feature chart, Col. Edwin L. Sterling was pictured as the ACIC Commander while the organizational article featured Col. Byron L. Schatzley. For the information of your readers, Colonel Schatzley is the present Commander of ACIC, having assumed command in July 1970. . . .

DAVID L. BLACK
Public Information Officer
Hq. ACIC
St. Louis, Mo.

• *Talk about the left hand not knowing what the right hand was doing. . . ! Our apologies to Colonel Schatzley and all of ACIC.*—THE EDITORS

Gentlemen: On page 128 of your May edition I found an error that should not have been made. You called the F-101 refueling from the KC-97 an F-4.

Shame on you! Your proofreader needs to take a fighter ID course.

CAPT. RONALD W. GIBBS
Shreveport, La.

• *Our proofreader is OK because the caption material furnished by the Air National Guard (who supplied the*

photo) calls it an F-4. But our caption-writer needs a crash course in aircraft recognition, since he's the one who should have been tipped off by the '101's distinctive tail and silhouette. Our thanks to Captain Gibbs and the other sharp-eyed experts who brought this to our attention.—THE EDITORS

Gentlemen: This is to call your attention to an incorrect identification on a photo that includes President Nixon and three other men in your May issue, page 27.

Robert Christy is on Mr. Nixon's left and is identified as president of the California Institute of Technology. He is the provost. The president, not shown in the photo, is Dr. Harold Brown, former Secretary of the Air Force.

GRAHAM BERRY
News Bureau Director
California Institute of Technology
Pasadena, Calif.

• *Another case of a pix that came in with incorrect caption material (not from CalTech). But we should have caught it—Dr. Harold Brown is well known to us.*—THE EDITORS

Gentlemen: The premier American space award is the Robert H. Goddard Memorial Trophy of the National Space Club. In your otherwise superb May issue you give appropriate recognition (p. 27) that former NASA Administrator James E. Webb, without whom the United States would not have won the race to the moon, received the Goddard Trophy. However, it is not an award of the American Astronautical Society. It was awarded by the National Space Club at their Goddard Memorial Dinner on March 11, 1971.

EUGENE M. EMME
NASA Historian
Washington, D. C.

Gentlemen: Having read the May 1971 issue from cover to cover, it seems that a few people that required plaudits were left out as a matter of course if the issue is an explanation of the makeup of the Air Force.

At Maxwell AFB, Ala., where the Air University is housed, also is Headquarters Civil Air Patrol-USA, commanded by Brig. Gen. Richard N. Ellis ["Headquarters Command, USAF" article, p. 109].

At Denver Air Reserve Personnel Center is the Headquarters, 9285th Air Reserve Squadron designed to administer the national organization of the Reserve Assistance Program of the Civil Air Patrol with the operational control through channels of the re-

Air Force F-15



Sperry's there!

For this nation's newest air superiority fighter—being built by McDonnell Douglas—Sperry is developing the attitude and heading reference system, the digital air data computer, the multi-function display, and the flux valve.

 **SPERRY RAND**
FLIGHT SYSTEMS
PHOENIX, ARIZONA 85002

Airmail

serve forces with wings, groups, and squadrons similar to the CAP. This group of reserve personnel is vital in helping the CAP function as a quasi-military organization and has been given formal attention by the Air Force.

Further, the AFCS article stated that the MARS initiated communications with persons outside of the Los Angeles earthquake area on February 9, 1971. This is true to an extent but it was the CAP who provided complete communications for the area in emergency units of all types and at Civil Defense and police headquarters.

MAJ. MELVIN B. JANOFF,
USAFR

Reserve Assistance Officer
USAF-CAP California Wing
Sherman Oaks, Calif.

Gentlemen: I would like to point out an error in your May issue. On page 106 ["Alaskan Air Command"], the tenth line from the bottom of the left-hand column reads, "Command's 29th Aerospace Rescue and . . ." It should have read "39th."

TSGT. THOMAS A. CLARK
NCOIC Information Office
Hq. 39th Aerospace Rescue and Recovery Wing
Richards-Gebaur AFB, Mo.

• *Investigation revealed that the original manuscript from Hq. AAC Information Office contained the wrong unit designation. We regret the error and have informed the AAC OI of the mistake.—THE EDITORS*

Who Remembers the Gremlins?

Gentlemen: I am doing research for a Master's paper on some of the stories and beliefs associated with flying and need information on the Gremlins—those little people who have given aircrews fits over the years.

I need information of any sort on this subject—tall tales, jokes, training or safety illustrations, or just the fact that there were some Gremlin stories going around in the different outfits. Also important is the name of the outfits, where located, and when were the stories told.

Any help on this project will be very much appreciated. I am hoping to preserve some of the flying folklore before it is lost forever.

MAJ. ROBERT L. BROWN
Chalet Apts. F
Chapel Hill, N. C. 27514

UNIT REUNIONS

CBI Theater Vets

The 24th annual reunion of the China-Burma-India Theater Veterans Association will be held August 4-7, at the Baker Hotel, Dallas, Tex. Contact

Col. Earl O. Cullum
P.O. Box 1981
Dallas, Tex. 75221

Romania POWs

A reunion of those held in Romanian POW camps during WW II will be held September 3-5 at the Holiday Inn, Fairborn, Ohio. For details contact

Anthony D. Polink
R.D. #2, Box 463-A
Uniontown, Pa. 15401

Wild Weasels

The Wild Weasel reunion will be held September 24-26, at the Radisson Hotel, Wichita, Kan. Please contact

Maj. Frederick L. Watkins
Information Officer
Hq. 23d Tac Fighter Wing (TAC)
McConnell AFB, Kan. 67221

4th Air Rescue

Flight C, 4th Air Rescue, 1947-1953, will have its annual reunion on August 21, 1971, at 1400 hours. Location: Leo P. Lee residence, 6819 South K Street, Tacoma, Wash. Pot luck-type picnic. Bring the family. For more information contact

Joseph D. Coyle
P.O. Box 18
Buckley, Wash. 98321

12th Tac Fighter Wing

The '71 reunion of the 12th Tactical Fighter Wing will be held September 10-12 at the Crystal City Marriott Hotel, Alexandria, Va. Most previous reunion attendees have been pilots who participated in Vietnam operations. This 4th annual reunion will include personnel from supporting units such as the 12th USAF Hospital and the 12th Combat Support Group. All officers and former officers of the 12th Fighter Wing and its support units since 1950 who have not been contacted please write, as soon as possible, to

Lt. Col. Kenneth A. Ward
Hq. USAF (XOOSLA)
Washington, D. C. 20330

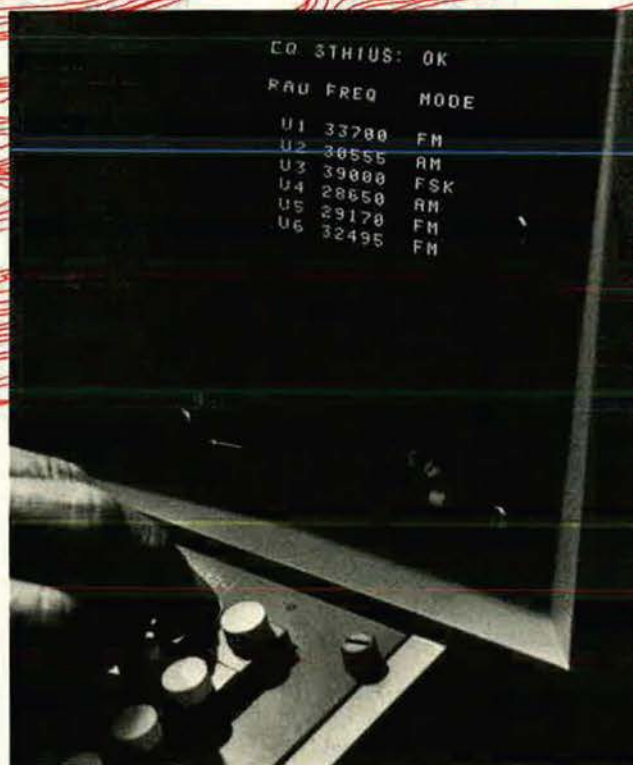
451st Bomb Squadron Association

The 23d annual reunion of the 451st Bomb Squadron Association, 322d Bomb Group (B-26), will be held the weekend of October 15, at Tampa, Fla. Lt. Gen. George Simler, one of the original second lieutenants in the 451st, will be a featured speaker. All former members of the 322d Bomb Group are invited. Contact

Kenneth S. Cohen
451st Bomb Sqdn. Association
220 Madison Ave.
New York, N. Y. 10016

Reunion notices must be in our hands eight weeks before the issue in which they are to appear.

fingertip management for total airborne systems



Airborne management functions—communication, navigation, identification, radar and fire control, surveillance and countermeasures, infrared, and other sensing functions—can be combined in a single system with Collins' approach to mission success.

Collins' new Avionics Management System eliminates losses in overall effectiveness caused by numerous and varied avionic units functioning independently under operational stresses. It also eliminates function duplication.

A central control panel provides aircraft commander and air crew with a single unit featuring integrated control and display of all system functions.

The system features in-flight performance monitoring, providing instantaneous status information on all interfaced systems, as well as complete management system check-out with a central integrated test system. Serial bit stream control saves weight and reduces complexity of installation. Three twisted pairs of wires—rather than multi-conductor cables—suffice. In some aircraft, this can save up to 15,000 feet of wire.

Other advantages include low life-cycle costs and expandability to more elaborate avionic systems.

For a five-minute film on Collins' Total Management System, contact: Collins Radio Company, Avionics Marketing, Cedar Rapids, Iowa 52406.



COMMUNICATION/COMPUTATION/CONTROL

Airpower in the News

By Claude Witze

SENIOR EDITOR, AIR FORCE MAGAZINE

The Threat Fixes the Cost

WASHINGTON, D. C., JUNE 7

The House Committee on Armed Services has approved a bill authorizing appropriations of \$21.9 billion for military procurement and research and development for Fiscal 1972. The vote in committee was thirty-six to four.

The recommended authorization is \$18.5 million less than requested by the Department of Defense.

This year's authorization report sets a different pace from those of other recent years, probably reflecting the shift in committee chairmen. Following the death of L. Mendel Rivers, the post was taken over by Rep. F. Edward Hébert, Louisiana Democrat. His study expresses few firm convictions about individual weapon systems, but does discuss trends in defense spending and the nature of the military threat to the United States.

There are efforts in the report to destroy a few myths. One of them is the constant reiteration that the Pentagon takes "more than half or two-thirds of our national budget." This is not so. The entire defense budget of \$77.6 billion requested for Fiscal 1972, if approved, would constitute 32.1 percent of what the government expects to spend in that year. It will be 6.8 percent of the gross national product.

Also of major importance is the fact, pointed out by the committee, that personnel costs are the ones that are mounting swiftly. In 1964, what the Pentagon spent on people was less than what it spent on procurement, R&D, construction, supplies, and services. In Fiscal 1972, the personnel costs will be higher than all other costs put together. That is why Defense Secretary Melvin R. Laird has said that personnel will be cut if he is forced to take a blanket slash in the budget.

The Armed Services Committee also cites the price of inflation, pointing out that the buying power of the proposed Fiscal 1972 defense budget is almost the same as that of the Fiscal 1964 budget. The cold figures make it look otherwise, as if there were an increase of about fifty percent.

Turning to the threat, the committee warns the House that this country does not control the things that form our national security requirements. It sees "no concrete evidence of a willingness on the part of the Soviets to decrease their military strength." And, "a willingness to talk about weapons should not be confused with actions on their development and deployment."

The report puts emphasis, in this regard, on the Soviet strategic effort, where they are spending about twice as much as the United States. Says the committee:

"If Soviet developments continue at their present rate and if United States defense expenditures are held to their present level, the only conclusion that can be reached is that ten years from now the Soviets will be in a position of clear superiority. . . .

"It is well to realize, also, that the Soviet buildup has not been as some people mistakenly believe, a long, slow, steady buildup. The buildup in Soviet strategic offensive weapons and strategic defensive weapons has mainly taken place since 1966, at which point they began a very rapid advance in the number of their strategic systems."

The Armed Services Committee has substantially increased the authorizations in two areas, over the amount provided last year. The bill provides \$3.3 billion for Navy ships, up \$863.5 million from Fiscal 1971. For RDT&E, the amount recommended is nearly \$8 billion. That is not only more than last year's figure, but \$12.5 million more than the Administration requested.

The committee has specified that \$14.6 million of the authorization can be obligated only for advance procurement for the nuclear-powered, guided-missile frigate DLGN-41. The construction of this ship is a tender point with the committee, which is upset by Defense Department delays on the project. There are only two nuclear frigates in operation and two under construction. The committee says Congress has had to force the Pentagon to build them, and it will not accept "disregard of the will of Congress" in this area.

On the subject of RDT&E, the committee said that inflation and cuts imposed by Congress over the past several years have seriously impaired the US effort. Meanwhile, the Soviet government has increased its activity until it now threatens our technological superiority.

For the Air Force, the authorization bill recommends \$3.1 billion for aircraft procurement and \$1.8 billion for missiles. Aircraft included are the A-7D (Ling-Temco-Vought); F-4E (McDonnell Douglas); F-111 (General Dynamics); F-5E (Northrop); RF-4C (McDonnell Douglas); C-5A (Lockheed); C-130E (Lockheed); T-41D (Cessna); and T-X (navigational trainer; contractor not selected). The missiles are the Minuteman ICBM, the Shrike, Maverick, SRAM, Sparrow, and Sidewinder.

On the subject of the B-1 strategic bomber, a USAF requirement now under heavy fire in Congress, the committee warns that further delays and stretch-outs will only add to the cost. The airplane, the report says, is a firm requirement because it is an essential part of the Triad approach to our realistic deterrent power. The bill provides \$370.3 million for the B-1, a project of North American Rockwell Corp.

The report rejects the idea that the land-based Minuteman and sea-based Polaris/Poseidon systems are adequate by themselves:

"At the present time, it appears that our present sea-based Polaris/Poseidon systems are reasonably secure. However, should there be technological breakthroughs in antisubmarine warfare on the part of our potential enemies, our sea-based strategic systems could be adversely affected. This country is exerting great effort and money in improving our own antisubmarine warfare capability, and we must assume that the Soviets are doing likewise."

On the subject of the F-111, the committee was not satisfied with the proposed Fiscal 1972 allocation of \$165.4 million. The report says many allegations about the F-111 are "predicated more on emotion than on fact" and the committee was "distressed" to learn that procurement of the F-111F had been cut from eighty-two to seventy planes. For this reason it has added \$112 million to the USAF authorization, with the stipulation that it is to be used only for this procurement.

The funds will pay for twelve more aircraft and keep the production line open for one year longer. Gen. John

D. Ryan, USAF Chief of Staff, is quoted as saying that it would cost \$162 million to close the line and reopen it, if required, in Fiscal 1973.

On top of this, the Air Force asked the committee for additional support for the Mk. II avionics system installed in later models of the F-111. This was approved. In total, the F-111 authorization then adds up to \$402.5 million.

The Lockheed C-5A transport is authorized the full \$357.2 million requested by the Pentagon. Says the report: "Although the C-5 program has been beset by financial difficulties and very unfavorable publicity in the news media, the aircraft has compiled an excellent record of performance." It says USAF expects the plane to "meet or exceed" operational requirements.

Two Army projects rating special comment in the report are the Lockheed AH-56A Cheyenne helicopter and the Safeguard ABM system.

The \$13.2 million sought for Cheyenne has been denied. The committee holds the funds should be withheld pending a report from Deputy Defense Secretary David Packard, who is chairman of a Pentagon study group examining the project. Congress last year ordered an evaluation of the Cheyenne; the Harrier, a British-made VTOL fighter used by the US Marines; and the proposed USAF A-X close-support fighter. In addition, the report says, the Army itself is preparing a report on the cost-effectiveness of the Cheyenne.

The committee will reconsider the programming when the Army makes such a request, if it does.

The bill authorizes the full amount requested, a little more than \$1 billion, for Safeguard. The report says that because the Russians are so far ahead in the development of offensive missiles and continuing work on their own ABM, the President's hand would be weakened if Safeguard were eliminated during the SALT discussions.

It also says that Safeguard has become technologically successful.

The four committee members who voted against the authorization bill were Representatives Otis G. Pike (D-N.Y.), Lucien N. Nedzi (D-Mich.), Michael Harrington (D-Mass.), and Charles W. Whalen, Jr. (R-Ohio).

In a dissenting report, they argue that the taxpayer will not get his money's worth from the bill if the program is approved. It is their view that the ABM system "adds little to the well-being of the average citizen" and that the entire defense program is wiping out the "long-promised Vietnam peace dividend."

MCPL Should Get It Right

The Members of Congress for Peace through Law, who favor unilateral disarmament, have published a new report on the Air Force and Navy tactical-fighter programs. The airplanes involved are the Grumman F-14 and the McDonnell Douglas F-15. The MCPL study, under the by-lines of Sen. Vance Hartke and Rep. Jonathan Bingham, would terminate the Navy's F-14. It says the Phoenix missile is too expensive and lacks capability against saturation attacks. Without the Phoenix, the F-14, the paper says, would have a low performance capability. It recommends that the Navy buy, instead, an advanced version of the F-4.

On the subject of the Air Force's F-15, a single-mission air-superiority fighter, the MCPL favors continued development. But it asks also that development be started on another lightweight fighter that would be less expensive. It argues that "such an alternative fighter should be designed for maximum speed and maneuverability at a cost between that of the F-4 and the F-15. A light fighter would provide a needed option to the F-15 in the event future budgetary restraints restrict the number of F-15s

we can afford to buy, or in the event the 'standoff' capability of the F-15 proves inadequate to counter enemy fighters and greater emphasis on speed and agility is required."

The first sentence in the MCPL discussion of the F-15 says: "The Air Force F-15 is strikingly similar in design to the F-111."

The fact is that the two aircraft have almost no similarity. The F-15 is a fixed-wing fighter, with a single pilot, designed for a single mission. It has high maneuverability and performance. The F-111 is a variable-sweep design. It lacks high maneuverability, but has a long cruising range, unlike the F-15. It carries a two-man crew. Most important, the F-111 is a multimission airplane, a fact that should be known by every member of Congress, even those who—like Senator Hartke and Congressman Bingham—are not members of the Armed Services Committees.

The MCPL report says further that the F-15 "is now anticipated to 'come in' at an even higher price than the F-14."

The Air Force says there is no evidence to support that statement. Congress has been given Selected Acquisition Reports (SAR) on this project, and the cost estimates included indicate that the F-15 will cost "substantially" less than the F-14.

Another MCPL quote:

"Furthermore, valid questions remain about whether the F-15's dependence on 'standoff' capability is sufficient to make it a match for the [Russian] 'Foxbat' [or MIG-23]. Should its 'standoff' weapons fail and should it be forced to close-in visual combat by an enemy aircraft such as the MIG-23, it is questionable whether the F-15 would have the speed and maneuverability to survive."

The reply to this is that MCPL has missed the feature. The F-15 is specifically designed for close-in maneuvering combat. It will have an advantage over any known enemy aircraft that it may meet in a match for air superiority. It would enjoy the widest margin of advantage over the MIG-23. The F-15, unlike such an aircraft as the F-111, has a low wing loading, high thrust-to-weight ratio, and a wing specifically designed for high lift maneuvering. The standoff weapons will increase its capability in combat and greatly complicate the problems of any possible enemy in the air.

The MCPL's report on the F-15, like its earlier effort with the B-1 bomber, does not reflect adequate research or sound technological consideration.

The Wayward Press (cont.)

In the *New York Times Magazine* of Sunday, May 9, there is an article about the plight of the Lockheed Aircraft Corp., written by Berkeley Rice. Mr. Rice also is author of a new book, *The C-5A Scandal*. The *Times* piece centers on the C-5A, an Air Force project, as an important factor in the development of Lockheed's state of financial distress.

Here is one sentence from the article:

"Gen. George Brown, the head of the Air Force Systems Command, also conceded recently that there had been 'some trouble in the maintenance area' and in the 'reliability' of the C-5A, but he insisted: 'We are working our way out of these problems.'"

Now, Mr. Rice, a free-lance reporter, obviously does not do his own leg work and get his facts firsthand. He picks them up from published material and selects the words he wants to support his editorial thesis. He uses the material without credit to the source.

We know that because the interview with General Brown was published in *AIR FORCE Magazine* in April, and we have a tape recording of what the General said:

"Nevertheless, the aircraft is technically sound and suc-

Airpower in the News

cessful. While we have some trouble in the maintenance area and in the reliability of the C-5A, these are no greater than we encountered in previous aircraft development efforts, such as the B-52. We are working our way out of these problems."

Mr. Rice, acknowledging no debt to AIR FORCE Magazine, deleted the important first sentence of the quotation and an equally important part of the next sentence. We defend his constitutional right to distort the meaning of General Brown's comment.

* * *

Here is a headline from the Washington Post of Sunday, May 16:

ARMED FORCES DAY MARKED BY ANTIWAR PROTESTS.

Here is a headline from the same day's Washington Sunday Star:

ARMED FORCES DAY UNMARRED.

* * *

Ten days later, on May 26, two newspapers reported on a hearing of the Joint Economic Committee, chaired by Sen. William Proxmire. The Washington Post story was written by Bernard D. Nossiter. He described testimony of Barry Shillito, Assistant Secretary of Defense for Installations and Logistics. These are Mr. Nossiter's words:

"Citing the large contractors' replies to a GAO [General Accounting Office] questionnaire, Shillito observed that the weapons makers reported higher earnings on civilian business (22.9 per cent) than on defense (21.1 per cent).

'The Selling of the Pentagon' (cont.)

Litigation Phase

The Columbia Broadcasting System and the Washington Post Company are being sued for a total of \$12 million on a complaint that says they "maliciously libeled and defamed the good name and character" of Col. John A. MacNeil, US Marine Corps, in the now-controversial TV program called "The Selling of the Pentagon."

Colonel MacNeil charges, before the US District Court for the District of Columbia, that the defendants "willfully and wantonly" rearranged a film of a lecture he delivered in Peoria, Ill., with the result that he was portrayed to the TV audience as saying what he did not say, making him "the object of public ridicule, odium, shame and contempt."

Among other things, Colonel MacNeil says he was made to appear as a military officer deliberately disobeying service regulations, that he was on a junket "criss-crossing" the country at a rate where he had to be "found" by the TV camera crew, and that he was propagandizing at the instance of the Caterpillar Tractor Co.

Further, the complaint contends that CBS and the Post caused the Colonel mental anguish and humiliation, as well as damaging his military career and outlook for promotion. The newspaper was included as a defendant in the case because it operates WTOP-TV, the local outlet for the CBS "documentary."

He dismissed as unrepresentative another portion of the story, based on GAO's independent analysis of defense contracts. It showed that pretax profits on investment averaged 56 per cent."

The New York Times of the same date, May 26, used an Associated Press report on the identical hearing covered by Mr. Nossiter. Said the AP, as reported in the Times:

"Mr. Shillito contended that profits of defense contractors overall average only 1.6 per cent.

"I find no evidence to support the inference that on the average the defense industry is a profiteering industry," he declared.

Somehow, the quotation used by the AP, and found fit to print by the Times, was not news in the Post.

What newspaper d'ya read?

* * *

According to the Associated Press, Walter Cronkite, possibly the major spokesman for the television news command and control centers of 1971, now sees "a clear indication on the part of this [Nixon] Administration of a grand conspiracy to destroy the credibility of the press."

Now, Mr. Cronkite works for the Columbia Broadcasting System, and it is true that CBS has had its credibility placed under fire in the spring of this year. But if Mr. Cronkite thinks this is something new in 1971, he is, without doubt, talking through his network hat. And if there is a conspiracy it is far older than the Nixon Administration.

For the past decade, starting in the Administration of John F. Kennedy, who was no conspirator in this area, we have had the Columbia Journalism Review, founded in the fall of 1961, with the statement that "what journalism needs . . . is more and better criticism." In the latest issue of the Review it is disclosed that, starting in 1968, at the tail end of the Lyndon Johnson Administration, there was established a Chicago Journalism Review.

Most of the points made in Colonel MacNeil's complaint were itemized in a critique of "The Selling of the Pentagon" that appeared in the April issue of AIR FORCE Magazine. Since then, the show has become increasingly controversial. Under scrutiny by the Subcommittee on Investigations of the House Committee on Interstate and Foreign Commerce, it has at the same time been singled out by the television fraternity for honors and awards that have included the George Foster Peabody award and, more recently, an "Emmy" from the National Academy of Television Arts and Sciences.

Congressman Harley O. Staggers (D-W. Va.), chairman of the subcommittee, has reiterated an earlier conclusion that "fraud and deception in the presentation of purportedly bona fide news events is no more protected by the First Amendment than is the presentation of fraud and deception in the context of commercial advertising or quiz programs." Mr. Staggers asserts that the distortion of news by staging or the manipulation of film and sound tracks is difficult to detect. For this reason, he has asked CBS to provide the subcommittee with the material not used in "The Selling of the Pentagon"—the clips from the cutting-room floor. He says this has nothing to do with evaluating the Pentagon's public affairs activities.

"Our purpose," the chairman declared, "is not to look into whether CBS has been 'biased' against the Department of Defense." That is not his concern. Rather, it is whether TV producers engage in "factually false and misleading filming and editing practices, consisting of rearranging, staging or misrepresenting events, giving viewers an erroneous impression that what they are seeing has really happened, or that it happened in the way and under the circumstances in which it is shown." He wants the subcommittee

As we go to press, the most recent publication is a media critique coming out of New York, called *More*. In this time period we also have on the record, as regular publications, the *AP Review*, *Journalists Newsletter*, *Hawaii Journalism Review*, *St. Louis Journalism Review*, *The Unsatisfied Man*, *Albuquerque Hard Times*, *Point of View*, and *The Village Voice*. According to the *Columbia Journalism Review*, granddaddy of them all, the family is growing fast.

TV's Walter Cronkite has not demonstrated, to our satisfaction, that the editors of these papers are taking part in a conspiracy headed by Spiro Agnew or any other executive of the Nixon Administration. The news media are under fire. Mr. Cronkite can find the reason much closer to his cameras and film editors.

One place to look is at a series of articles published recently in *TV Guide*, authored by Richard Townley, who describes himself as a journalist who was disappointed in his effort to practice his profession with the techniques dictated by television. Mr. Townley, in fact, could find little merit in the professional competence of TV news specialists. He was completely turned off by the measure of news values that said, "One race riot is worth two rating points." There is no suggestion in *TV Guide* that Mr. Townley, or the publication, is engaged in a conspiracy against the press.

It may be that Mr. Cronkite, being in the TV business, does not read *Editor and Publisher*, the trade journal of the newspaper business. In the May 8 issue there is an announcement that an organization called Accuracy in Media (AIM) has opened national headquarters in Suite 1012 of the Warner Building, 501 13th St., N.W., Washington, D. C. 20004. AIM is more than two years old, and there is no evidence that the Nixon Administration played any role in its formation. It is described as "a private nonpartisan organization designed to foster greater ac-

curacy in reporting by seeking correction of serious errors found in both the print and broadcast media."

AIM says it stands "ready to receive complaints of serious inaccuracies in the print and broadcast media, and we shall attempt to determine if an error has been made and obtain correction when appropriate." AIM deals with matters of journalistic accuracy, not with matters of taste. AIM is not part of a conspiracy. ■

to consider whether the public has a right to know when "edited sequences are presented to them under conditions which might suggest that they have not been edited." He does not believe such an inquiry "is offensive to the First Amendment."

First witness on the stand before Mr. Stagers was Daniel Z. Henkin, Assistant Secretary of Defense for Public Affairs. Mr. Henkin spoke up strongly for the integrity of CBS News and its right to criticize the Pentagon. At the same time, he said he was "disappointed and concerned by the doctoring of words and misrepresentations" in this particular show. He said his own interview in "The Selling of the Pentagon" was distorted by the producers. He quoted Roger Mudd, who narrated the show, as holding the opinion that "the tube has become a trip, a national opiate, a baby sitter who charges nothing, something to iron by and to shave to and to doze over." Mr. Henkin made it clear that he has a much higher opinion of television's potential than Mr. Mudd has expressed.

It was at the Stagers hearing that first public mention was made of the libel suit filed by Colonel MacNeil. Because of the legal action, the Colonel was not asked to testify. Instead, an affidavit was filed over his signature, saying he had no objection to having films and other material in possession of CBS turned over to the subcommittee.

The MacNeil complaint was filed in District Court on May 5. The hearing, at which Mr. Henkin testified, was on May 12. It was on May 13 that the Colonel's suit first got attention in the press. The New York *Times* of that day, taking its cue from Chairman Stagers' disclosure of the MacNeil affidavit, told about the suit, in which the Colonel had "charged that the network had, in effect, made him out to be a 'liar.'" The story got thirty lines of type.

'They're After Me'



—Chick Larsen, in the Richmond, Va., Times-Dispatch, with permission

Now, the *Washington Post* was named as a codefendant in the MacNeil suit. In the *Post* of May 13, the lawsuit was brought to the attention of Washington readers in a different way. May 13 was a Thursday, a day when the *Post* has a heavy advertising burden and an immense paper. The news report on Mr. Henkin's appearance before the Stagers subcommittee was reported, factually, on page A-7, which is in the first news section and a fairly prominent position for the event. Unlike the *Times*, the *Post* account included no mention of the fact that Mr. Stagers had talked about the MacNeil suit and given copies of the MacNeil affidavit to the press table.

Only the few readers who examined the *Post* carefully on the morning of May 13 would have discovered a four-column headline on page E-1 that covered some items of local news under the banner: "JURY ORDERS PR. WILLIAM TO PAY \$334,800 FOR LAND." This covered the top item, about a condemnation proceeding involving a local highway in Prince William County, Va. Under this item, the persistent reader could uncover, with diligence, a tiny subhead that said, "LIBEL SUIT." Here, it was disclosed that one John A. MacNeil of Alexandria, Va., had filed a suit against CBS and the *Washington Post*. The plaintiff was identified as a "military officer." The item got twenty-two lines of type, eight less than it received in a more prominent position in the *Times*. At no point in the twenty-two lines was there any suggestion that Colonel MacNeil is a colonel. His title was ignored. Nor were there any details about the Peoria filming and how it was edited by CBS.

The *Washington Post*, of course, abhors news management.

—C.W.

MIA/POW Action Report

By Maurice L. Lien

SPECIAL EDITOR FOR MIA/POW AFFAIRS

European Tour

On Memorial Day 1971, 174 members of the National League of Families returned to the US after an eight-day tour of European capitals, seeking help for loved ones. The trip was timed so that the group would be in Geneva, Switzerland, when some thirty-five nations who are signatories to the 1949 Convention Relative to the Treatment of Prisoners of War were meeting in that city.

The League had asked to be placed on the agenda for the International Red Cross-sponsored meeting, but was refused. Instead, on May 23, League members formed outside the building, where opening ceremonies were held, and handed out an open letter to delegates, asking that the nations represented live up to their obligations under Article I of the 1949 agreement, which reads, "The High Contracting Parties undertake to respect and to ensure respect for the present Convention in all circumstances."

In explaining the appeal to the international body, Mrs. Joan Vinson, National Coordinator for the League, said, "We hoped to impress on the nations represented in Geneva that the crime perpetrated by North Vietnam has been allowed to exist only because the duties of other signatories have been unfulfilled. They have not 'ensured respect for the present Convention.' And, unless they do so, the Geneva Convention serves no legal or humanitarian purpose.

"Although we have no way of knowing at this time the ultimate results of our efforts," Mrs. Vinson said, "we do know that on the first day of the conference, the matter of prisoners of war—which had not previously been on the agenda for discussion—was introduced by another country."

The MIA/POW families, from thirty-two states and England, landed in Geneva on May 22. From there, some forty-five members fanned out to visit nine other capitals, including Warsaw, Poland, calling on government and Red Cross officials, before rejoining the group in Paris for the return flight to the US. Nearly the entire group was on hand in Paris on

May 27 to observe the arrivals of the four parties involved in the Peace Talks.

"Reporters present asked the North Vietnamese and the Provisional Revolutionary Government (Viet Cong) delegates if our members would be permitted an audience with either of their delegations," Mrs. Vinson said. "The PRG representative refused. The North Vietnamese representative stated that he did not feel his delegation would have time enough to meet with us, but indicated a meeting could possibly be arranged between some of our members and their embassy.

"Immediately thereafter we contacted the North Vietnamese, requesting an appointment for five of our members," Mrs. Vinson reported, "and were told that they would call us back with an answer. In toto, we contacted them seven times, and each time we were told 'No appointment has yet been arranged.' Needless to say, we were extremely disappointed in the other side's refusal to see us."

Press Conference

At a June 1 press conference, in Washington, D. C., in a prepared statement and reporting on the League's visit to Paris, Mrs. Vinson said, "Because the President said that he wanted a commitment from the Communists regarding the release of prisoners, we attempted to contact the North Vietnamese and the PRG to ask them to make this commitment publicly to Ambassador Bruce. We have been deeply frustrated by the reports of various congressmen and newsmen and other groups who sincerely believe that the other side has made a commitment for the release of prisoners of war. However, no such statement is on the official record, although those words would clear the way for the President to announce total withdrawal of troops from Indochina.

"We would like to see both sides demonstrate more flexibility and conciliation than is represented by the oversimplified 'Set a withdrawal date, and we'll discuss the release of prisoners,' and 'Promise to release the prisoners and we'll discuss a withdrawal

date.' Surely there is room for negotiations somewhere between these two undeviating positions."

The statement continued: "It has been charged that the prisoner-of-war question is not the real issue . . . that it is being used as an excuse by one side or the other to prolong the war and avoid a settlement at this time. . . . If the prisoners are not the real issue, then it is time for both sides to start



"POWs—The Silenced Americans" is the title USAF gave this poster, sent to base newspapers around the world.

talking about what may be the real problems in achieving a settlement of this war.

"The prisoners should be removed from such bartering and afforded the protections dictated by humanitarian law. . . . We do not want the prisoners to be the only reason we remain in Vietnam, nor do we want them to be the only reason we leave."

Media Mayhem

CBS Television, on its nationally broadcast evening news program on June 1, included two paragraphs from Mrs. Vinson's statement:

"In no other war in history have prisoners been used to this degree to bargain for political concessions. It seems to us that the whole question of peace in Indochina has now been focused, by both sides, on the prisoner-of-war issue. If the handling of prisoners truly is a major stumbling block, then it seems to us that it can be solved very easily by relatively minor moves by both sides.

"It's difficult to imagine that our relatives in Southeast Asia can survive any more extended wrangling and negotiations. The North Vietnamese have told us that they do not intend to take the first step. They do not intend to release and account for our



State President Clyde Stricker presents an AFA Certificate of Honor to Maj. Merl Groton, for MIA/POW work of Spokane, Wash., Chamber of Commerce.

relatives until after the date for total withdrawal has been set. We can, therefore, only hope that the President and his negotiators in Paris are prepared to initiate other means of resolving the war in Indochina and securing the release and accounting for our men."

The CBS News commentator concluded this segment of the telecast by stating: "Last week a group of relatives accused the Administration of using the prisoners to stall the American withdrawal in order to give the South Vietnamese more time to build up their own forces. This is the first time, however, that the group leader-



Georgia AFA MIA/POW Campaign Chairman Sam Elkins (left) presents more than 25,000 signatures to Savannah Assistant Postmaster Frank Hester for mailing, while Mrs. Arthur Lord, Jr., (POW), and Mrs. Norma Pfordt (MIA) look on. The mailing was one of many in the campaign.

ship has openly criticized the Administration."

The morning following the news telecast, both the League's Washington, D. C., office and the USAF Casualty Assistance Office at Randolph AFB, Tex., were besieged with telephone calls from irate families from all over the US, stating they did not agree with the League's position as



National League of Families members pose for a group photo at Intercontinental Hotel, Geneva, during an eight-day tour of European capitals.

reported by CBS. The families also said that they continued to back the Administration in its negotiating stand in the Paris Peace Talks.

According to this reporter's notes, Mrs. Vinson, in response to questions asking if the League was being critical of President Nixon, said "No, not in that vein." She repeated, however, that they would like to see both sides demonstrate more flexibility and conciliation and would like the President to be prepared to announce a withdrawal date if the Communists announce officially that they will release the prisoners on or in conjunction with that date.

My Daddy Is Missing in Action

By Debra Fisher, age 14

I live in a world of opaque blackness,
Endlessly wondering, day by day,
Hour by hour, minute by minute,
Until the very earth seems topsy-turvy.
Thick black veils of frustrating
Anguish constantly shroud me,
Wiping out all reason, all wants,
Except to cry . . . I do.

Stubborn tears flow down my cheeks.
Tormenting questions crowd my mind.
I reach out to grasp for elusive
Rays of hope—maybe in vain . . .
Maybe not.

I struggle to find a reason, an answer,
Someone to blame. I want to know why.
But I am in the darkness, and God keeps
His secrets.

Then, the darkness gives way to light—
And I tell myself, for the thousandth time,
"This must be a dream, I will waken . . ."
But again I hear that faint, haunting, echoing
answer,
. . . "It isn't."

Can't someone, anyone, somewhere tell me . . .
Do I have a Father anymore?

(Miss Fisher is the daughter of USAF Maj. and Mrs. Donald G. Fisher, of Laurel, Miss. Major Fisher has been missing in action over Laos for fifteen months.)

When asked by reporters if the League felt the Administration was using the POW issue as an excuse to prolong US presence in Southeast Asia, as some relatives have charged, Mrs. Vinson replied, "We do not believe so."

Margaret Crimmins reported in the *Washington Post*, a newspaper not known for supporting the Nixon Administration, that Mrs. Vinson, responding to repeated questions such as "Does this statement mean a break with the Administration?" and "Are you disenchanted with President Nixon?" replied "No, this is not a break with the Administration." ■

By William P. Schlitz

NEWS EDITOR, AIR FORCE MAGAZINE

WASHINGTON, D. C., JUNE 14

A number of Air Force weapon systems have come under critical review by a Capitol Hill group called the Members of Congress for Peace through Law. A key target is the Air Force's new strategic bomber—the B-1.

One recommendation by the group centered on a Boeing Co. proposal to modify late-model B-52s, thereby eliminating the need for a new bomber.

The Air Force's response to the group's proposal, stated by Sen. William Proxmire (D-Wis.), noted the following:

Boeing Co.'s idea to reengine the B-52 was originally presented to the Air Force in January 1969 and was the result of preliminary looks into increased B-52 range and payload capability. Boeing's plan was to modify the B-52 with four General Electric TF39 engines (powerplant of the C-5). In 1969, Boeing estimated the prototype program at two years, with a cost of \$6 to \$10 million. Now, Boeing estimates the cost at approximately \$40 million.

Since in 1969 no formal proposal

was submitted, no official USAF response was forthcoming. The Air Force did consider the merits of the Boeing suggestion, however.

In its reply to the group, USAF also said that, by 1980, B-52G and H models will be about twenty years old. "Some \$3 billion has already been spent over the years for structural modifications, capability improvements, and depot maintenance to keep them safe and effective." Since limitations exist to what can and should be done to aging aircraft, USAF "has carefully selected those modifications most urgently needed to maintain the B-52's combat capability in the face of a growing Soviet threat. Another decade of flight might well require more extensive and expensive modifications than in the past."

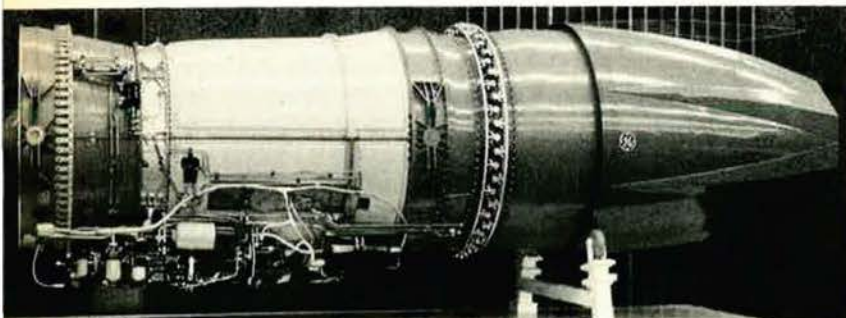
The Air Force said that reengining the B-52 would not significantly enhance prelaunch survivability since the B-52 nuclear-effects hardness and maximum allowable escape speed are unchanged. "Additionally, the larger engines would require much greater start time. It is not presently possible to provide quick-starting capability on

the TF39-type engines. Boeing's data on reengining the B-52 included some structure modifications designed to support the engine installation and therefore would increase the airplane's maximum gross takeoff weight. A configuration change of this magnitude would not increase the B-52 flying-hour service life but would decrease the service life remaining."

The Air Force went on to add that reengining would not improve the B-52's survival during penetration of Soviet air defenses. "Since the present aircraft are programmed to carry all the payload of which it is capable, it was determined that the greatest enhancement to penetration could be achieved by other means. Therefore, the Air Force is planning to equip the B-52s with the Short-Range Attack Missile (SRAM), the Subsonic Cruise Armed Decoy (SCAD), Electro-optical Visual Sensors (EVS), and continuing improvements in electronics countermeasures (ECM)."

The Air Force said that it has used its experience with the B-52 to design an airplane that would react faster to reach a safe escape distance, would

The artist's concept to the right illustrates what would be a typical mission for the Air Force's new B-1 bomber—penetration of an enemy's defenses at low levels. "Ground clutter" would help shield B-1s from radar surveillance in such instances. Below is a mockup of the B-1's engine, currently under development by General Electric. The B-1 is to have four such powerplants, each rated at 30,000 pounds of thrust. First flight of the new plane is scheduled for 1974.





—Wide World Photos

Apollo-15 Astronaut Alfred M. Worden uses a model to show how he will space walk to exterior equipment on the return from the lunar landing. Worden will pilot the Command Module while his two associates are on the lunar surface. The Apollo-15 crew is scheduled to blast off on July 26 (see p. 21).

take off at a closer interval on each runway, could be dispersed to more runways, and have a designed inventory life of twenty-five years. The B-1 bomber proposal was the result.

The Air Force said that the B-1 would reach a safe escape distance from a nuclear detonation over a base much faster than a B-52. "The smaller dimensions of the B-1 would permit it to take off with a spacing interval between aircraft of one-half" that of the B-52. Also, the B-1's shorter take-off distance would make available about 150 more runways than are available to the B-52, thereby permitting greater dispersal and faster reaction by the alert force. "Additionally, the B-1 would have a significant range payload advantage over the B-52." The B-1 would carry twice the bomb load of the B-52.

The B-1 would have faster penetration speed, lower penetration altitude, reduced radar cross section, and smaller infrared signature than the B-52. "These factors combine to preclude a tail-chase intercept by the current Soviet manned interceptors—eliminating a major portion of the Soviet interceptors as a threat," the Air Force said.

Finally, concerning weapon delivery, "the B-1 (by virtue of better avionics) would be able to deliver its payload more accurately than the B-52."



DoD has picked Boeing's Vertol Division for the first development



Walter T. Bonney, a former AFA National Director and NASA's first Director of Information, retired in May from Aerospace Corp. He'll live near Washington, D. C.

phase of a heavy lift helicopter (HLH) for all the services. Army has been assigned overall responsibility for the project, with the Navy participating.

The R&D contract is an estimated \$76 million, with funding by Army/Navy.

Boeing's proposal utilizes tandem rotors and transmissions not very much larger than systems already in operation, thus reducing development costs and negating parallel industry competition, DoD said in reply to congressional criticism concerning the lack of competition for the contract.

DoD also authorized a separate program to meet Navy/Marine Corps needs for a ship-based copter with lift capacity greater than currently avail-

Jack Tippit (left), an Air Force Reserve colonel, accepts a plaque for the "Best Syndicated Panel of the Year" from Milton Caniff. Tippit won the award for his cartoon strip "Amy." A former B-24 pilot, Tippit, assigned to the Office of the Secretary of the Air Force as Reserve editor of AIRMAN Magazine, was recently elected president of the National Cartoonists Society. His cartoons have appeared in AIR FORCE Magazine, among other publications.



Walter Zaharevitz (left), an AFA member and Executive Director of National Aerospace Education Council, receives the Frank G. Brewer Trophy for 1970 from Dr. M. K. Strickler, Jr., representing the National Aeronautic Association. Zaharevitz, a private pilot and qualified secondary-school and college-level teacher as well as a noted writer and editor, was cited for "his unflagging endeavors in developing and introducing aviation and space concepts to the youth of the nation."

Vice President Agnew presided in May at the Harmon International Aviation awards to, seated from left, RAF Squadron Leaders Graham Williams and Leslie Lecky-Thompson, who flew the Atlantic in a Harrier; Turi Wideroe of Norway, the first woman regular airline pilot; and the Apollo-11 crew (not shown).

—Wide World Photos





**Westinghouse delivers—
VLF to GHz, any environment.**

Westinghouse signal capabilities are full spectrum: basic research to operating systems—in all frequency regions, VLF to GHz—land, sea, or air.

We're ready to help you in all operational environments: shipboard communications and navigation, LF/VLF communications, satellite communications.

For more information, contact Westinghouse Electric Corporation, Aerospace & Electronic Systems Division, Baltimore, Maryland 21203.

AA-2-71



You can be sure . . . if it's Westinghouse

Aerospace World

able, probably an upgraded helicopter of the CH-53 type now in Navy's inventory.

Once development of the HLH is completed, a decision will be made regarding further work toward an operational helicopter.



The next manned trip to the lunar surface—Apollo-15—is scheduled for launch from Cape Kennedy on July 26.

The Apollo crew will don spacesuits for work in the space vacuum five times during the mission, for a total of twenty-one hours—or more time than all other Apollo flights combined.

Following landing in the moon's Hadley-Apennine area, spacecraft commander David R. Scott will photograph and describe the landing site from the top hatch of the lunar module for about thirty minutes.

Also, Scott and Astronaut James B. Irwin will take the lunar roving vehicle to the base of the 13,000-foot-high Apennine Mountains, to the edge of the mile-wide, 1,200-foot-deep Hadley Rille, and finally to north of the landing site where interesting volcanic-like surface features have been observed. These trips are to occur on July 31, August 1, and August 2, and will total about twenty hours.

Later, during the Command Module's return to earth, Alfred M. Worden will retrieve film magazines from the scientific instrument module on the spacecraft's exterior.

And, early next year, NASA will put three men into an altitude test chamber for a grueling, fifty-six-day endurance trial.

The aim is to acquire medical data and evaluate medical-experiment equipment for the space agency's manned Skylab project, currently set for orbit in 1973.

The simulated mission, to take place at Houston's Manned Spacecraft Center in a chamber modified to resemble the crew quarters of the Skylab Workshop, will involve sixteen medical experiments, including nutritional investigations, energy expenditure, and cardiovascular studies.

The test crew, still to be selected, will duplicate closely the activities planned for the actual mission, including a work schedule, eating, sleep, and recreation.

Recreational equipment will include television, tape recorders, chess, check-

ers, playing cards, sketching materials, exercise devices, books, writing materials, and other individually selected items.



The Soviets are taking dramatic steps in their race to establish routine manned space-station capability (for a detailed projection of their plans, see "The Soviet Space Effort—An Analysis," by Foy D. Kohler and Dodd L. Harvey, AIR FORCE, June 1971).

On June 6, they orbited a three-man Soyuz-11 spacecraft, which they subsequently docked with their already-orbiting Salute "space laboratory." The successful docking was followed by crew transfer from the Soyuz-11 and a rocket firing to take Salute into a higher orbit to prevent it from reentering the earth's atmosphere and being destroyed. At this writing, there was speculation that an additional manned Soyuz craft might be orbited to rendezvous and transfer its crew to the Salute, to create the first six-man prototype manned space station.

Salute's task? According to the Russians, the onboard crew will perform engineering, astrophysical, and medical experiments. While the reticent Soviets have not revealed whether Salute is to be the core of a long-term space lab or is simply experimental, they have coined some new terminology for this mission—"cosmodom," meaning "space house," and "cosmograd," meaning "space city."

The Soyuz-11/Salute mission followed by several weeks the less impressive April operation in which Salute was followed to a rendezvous by Soyuz-10, the crew of which did not transfer to Salute but returned Soyuz-10 to earth. At the time, ob-

servers in the West indicated that something had probably gone wrong with the mission.



In the face of a series of congressional decisions to withhold funding from the US's SST program—prospectively this country's most ambitious aeronautical undertaking—efforts to resurrect the project through private financing have apparently failed.

The Department of Transportation has advised Fairchild Industries, which was investigating ways to finance the SST by private means, that attempts to secure such financing appeared "fruitless."

This assumption hinged mostly on the reluctance of Boeing Co. and General Electric Co. (aircraft and engine builders, respectively) to continue SST development without full government support, now highly improbable.

But this does not mean that US industry will discontinue all activity in the supersonic transport field; it will probably make a bid for participation in the British/French Concorde SST project, by conducting research and development associated with a second-generation SST. This would include emphasis on improved aerodynamics, configuration, and propulsion.

DOT said that commercial supersonic travel is the "next logical improvement in international air travel" and that it is "watching with great interest the progress of the Concorde" and the Soviet Union's TU-144 supersonic transport, both stars of the recent Paris Air Show.



US military pilots that are listed MIA/POW in SEA will find careers open as airline pilots on their return



—Wide World Photos

At an air show in May at Alton, Ill., were former RAF Group Captain Peter Townsend, in the cockpit of a British Spitfire, and, center, his wife, Marie-Luce. On the right is Germany's and the world's top all-time ace, Erich Hartmann, with 352 aerial victories. On the left is Don Volkmer, of Addison, Tex., who sponsored the air show and reunion near St. Louis, Mo.

Aerospace World

home, hopefully in the not-too-distant future.

The program is the idea of Eastern Air Lines First Officer Charles (Chuck) Dyer, a naval Reserve pilot from Boston who has three friends believed held in North Vietnamese POW camps.

The plan, announced by the 31,000-member Air Line Pilots Association late in May, calls for seniority (hiring) of ex-MIA/POW pilots to be pegged to May 30, 1971. All pilots meeting physical and training requirements within a year after release will qualify for employment and the considerable date-of-hire benefits.

The program is regarded as "a small but important reward" for the sacrifice made by the pilots, and was worked out with former Astronaut USAF Col. Frank Borman, currently Eastern's Vice President for Operations.

Of the 1,500 Americans carried MIA/POW, several hundred are believed eligible. Under the ALPA/Eastern plan, the latter will train the pilots for airline operations. ALPA pilots fly aboard forty-one domestic and US flag carriers.



The Red River Valley Fighter Pilots Association—made up of aircrew members who flew at least one combat mission in North Vietnam's infamous Red River Valley—is seeking to expand its scholarship fund program for children of member fathers held prisoner, MIA, or who were killed in action in Southeast Asia.

The association established the program last year with three \$1,000 scholarships, with selections from twenty-nine applicants.

At this time the eligible children number more than a hundred and "our goal is \$1,000 scholarships for all," said Col. Howard C. Johnson, of Perrin AFB, Tex., credited with founding the organization. "To achieve this we need the help and support of companies and individuals alike, no matter how small or large," he said.

Applications and contributions should be made to the Red River Valley Fighter Pilots Association, Scholarship Fund, P.O. Box 9736, Nellis AFB, Nev. 89110. Donations are tax deductible.



It seems hard to believe, but aircraft flight simulators are now so efficient that they far exceed the effectiveness of training pilots in actual flight.

This is true of both military and civilian flight training and envelopes such areas as cost, thoroughness of instruction, and safety and emergency conditioning.

In the commercial field, experts predict that soon all training of veteran pilots in new aircraft will be conducted via the simulator, followed by an actual flight in the way of a "final examination" to acquire FAA rating. (One goal is to make this last step unnecessary, since to a certain extent it is largely psychological.)

This trend to simulator instruction is dictated by various practical considerations, one being the high cost (thousands of dollars) of aircraft operation compared to that of the simulator (perhaps several hundred).

Another factor is pilot experience in responding to emergency situations; simulators can program an almost incredible range of problems (500 in some cases)—malfunctions impossible or impractical to duplicate in actual flight.

Some simulators, such as that developed for Lockheed Aircraft Corp.'s L-1011 TriStar by CAE Industries Ltd. of Canada, have automated instruction capability, including record and playback, and an isolation switch

that permits flight engineers to work on systems faults without affecting cockpit instrumentation.



The Air Force has been picked to construct at Travis AFB, Calif., a 500-bed hospital that will serve as prototype of future military hospitals for all the services.

Construction of the hospital is part of a DoD project to improve the overall design and efficiency of military hospitals.

Among features of the medical facility, building of which is to begin late in 1973, will be a floor plan arrived at with the help of a computer. This follows the systems analysis studies begun in 1969 of the existing DoD hospital system.

Other features include reorganized ambulatory and intensive care areas, design of self-help beds, use of convenience foods, and increased automation in laboratory and radiology departments.

OSD's Hospital Planning Review Committee, which is overseeing the project, plans to include a request for funds for the hospital in the FY 1974 Military Construction Budget.



USAF currently is reshuffling segments of its SAC units to ensure "that strategic bomber and tanker forces are in the best possible position to survive and retaliate in light of the current threat, changing technology, and world communications."

The realignment actions are affecting the following:

- March AFB, Calif.—The 909th Air Refueling Squadron (fifteen KC-135 Stratotankers) will be relocated to Kadena AB, Okinawa, by September 30. Inactivated also by that date will be the 486th Bombardment Squadron (fifteen B-52Ds). Along with a cut in Fifteenth Air Force Headquarters staff, March will experience a reduction of 1,398 military and fifty-nine civilian personnel.

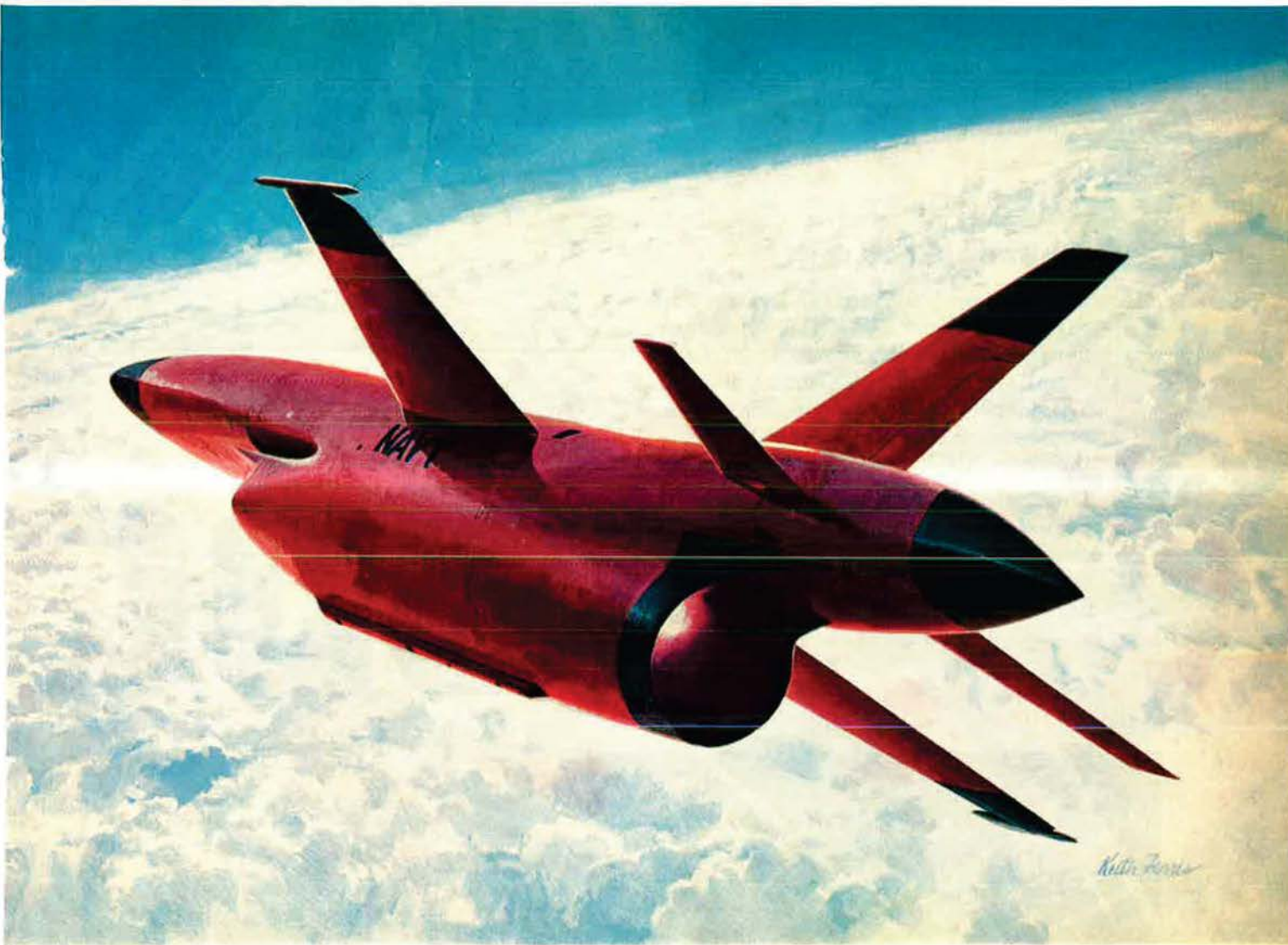
- McCoy AFB, Fla.—The 919th Air Refueling Squadron is being inactivated, with its fifteen KC-135s transferred to other SAC units. The 823d Strategic Aerospace Division also is being inactivated. SAC personnel at McCoy will be reduced by 230 military and two civilians.

- Barksdale AFB, La.—Inactivation of the 2d Reconnaissance Technical Squadron, and a cut in staff of Second Air Force Headquarters, is resulting in a reduction of 585 military and fifty-five civilian personnel at the base.

- Ramey AFB, P. R.—This summer, Military Airlift Command will

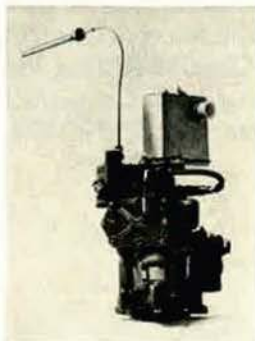


Representatives of the military forces of Australia, New Zealand, and Switzerland join US Navy and Marine counterparts to celebrate the arrival of the 2,500th McDonnell Douglas A-4 Skyhawk. USMC took delivery of the A-4M at Andrews AFB, Md., in April. Fourth from left is Donald W. Douglas, Jr., senior vice president of McDonnell Douglas. Verslons of the A-4 have been in continuous production since 1955.



FROM AN ORIGINAL PAINTING FOR CHANDLER EVANS

MAIN FUEL CONTROL by Chandler Evans



MC-33 Main Fuel Control

Teledyne Ryan Aeronautical's new supersonic Firebee II is an unmanned aerial jet target produced for the U. S. Navy and the Air Force. The 1,000 m.p.h. remote control target is powered by a Teledyne CAE YJ69-T-406 engine equipped with a main fuel control engineered and precision-produced by Chandler Evans.

This CECO product on the Firebee II joins a distinguished line of pumps, main fuel controls, afterburner controls and other aerospace components in an array of important military aircraft as well as many of the latest missiles and commercial aircraft.

Chandler Evans is pleased to be "known by the company its products keep" and by the records those products establish.

Colt Industries



Chandler Evans Control Systems Division

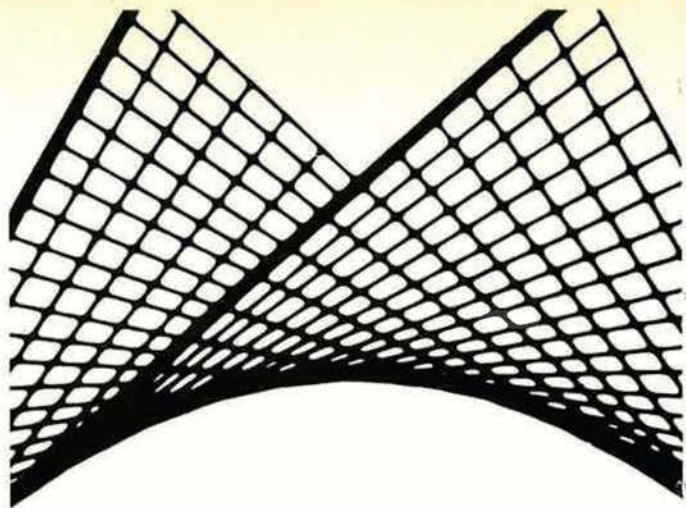
WEST HARTFORD, CONNECTICUT 06101

GAS TURBINE CONTROLS/PUMPS • AIRCRAFT/MISSILE CONTROLS, VALVES AND ACTUATORS

The majority

of Command & Control Systems in the free world—SEEK DAWN, Space Defense Center, SAGE, BUIC, NORAD Combat Operations Center, SAC & TAC Control Systems—use data system engineering by the company that wrote the book. SDC.

We're also extending the operational period of existing systems through data system engineering improvements—another area of expertise provided by our 14 years of experience in the field.



SDC



For the new generation

of Command & Control Systems, we're in the forefront of data system development: TIPI, SAFEGUARD, AABNCP, Air Combat Maneuvering Range, TACS/TADS, TACC Automation, NTDS, Marine Air Command and Control System and others that we can't even talk about.

For information about SDC's capabilities in Command & Control, please call or write Charles Alders, Vice President, Marketing and Corporate Relations. Telephone: (213) 393-9411.

System Development Corporation

2500 Colorado Avenue, Santa Monica, California 90406



Aerospace World

assume control of the base from SAC. The 72d Bombardment Wing there is being inactivated, with its fifteen B-52Gs transferred to Ellsworth AFB, S. D., to modernize the 77th Bombardment Squadron, previously equipped with B-52Ds. The 72d's fifteen KC-135s are going to other SAC units. SAC reductions at Ramey affect 2,050 military and eighty-five civilians.

- Kincheloe AFB, Mich.—The 908th Air Refueling Squadron will receive five additional KC-135s this summer, and the base will revert to SAC control from ADC. The actions will increase base strength by eighty-eight military and four civilians.

- McConnell AFB, Kan.—This summer the 91st Air Refueling Squadron (twenty KC-135s) will be activated. This will increase SAC personnel by 779 military and ten civilians.

- Westover AFB, Mass.—By September 31, the 348th Bombardment Squadron will be converted from fifteen B-52C aircraft to ten B-52Ds, resulting in a personnel decrease of 312 military and three civilians.

- Grissom AFB, Ind.—The 305th Air Refueling Squadron will be increased by ten KC-135s, and military personnel by 269.

- Carswell AFB, Tex.—The 486th Bombardment Squadron will be activated with fifteen B-52D aircraft that have returned from Southeast Asia. Strength at the base is to increase by 492 military and six civilians.

- Dyess AFB, Tex.—The 337th Bombardment Squadron will be increased by five B-52Ds by September 30, adding 136 military and one civilian at Dyess.

- Lockbourne AFB, Ohio—The base is reverting to SAC control from TAC.



The Air Force has gone to the dogs—or so the folks at the Lackland AFB, Tex., Dog Center would have you believe.

The Air Force has the job of procuring canines for all the services and at Lackland it gives them training as patrol and sentry dogs. (The individual receiving service provides additional training in scouting, tracking, and other canine specialties. For its part, USAF prefers patrol dogs that respond to a wider range of vocal or signal commands than the previously used sentry dogs.)

After training, many dogs have

served in Southeast Asia; the military has used them effectively there since 1965. Presently, there are about 1,400 dogs in Vietnam: 1,000 Army, 300 USAF, and 100 Marine Corps/Navy. There are about 5,500 military working dogs worldwide.

And now, as US participation in the war dwindles, the dogs, too, are coming home. The first group of veterans arrived back at Lackland late this spring. Others—presumably career-minded types—are being reassigned to posts around the Pacific and elsewhere. Dogs not finding posts overseas are being returned to the US for retraining or redistribution. Dogs found surplus to military needs in the States will be transferred to other government or law-enforcement agencies—sort of “second-career” assignments. Unlike their human counterparts, however, there is no plan to return military dogs to civilian status.

Actually, it is through the efforts of

medical science that dogs now can be brought home. Until relatively recent times, the dogs sent to SEA inevitably caught a Pacific-area, anemia-like disease that ultimately proved fatal. Now, to assure good health, they are treated with antibiotics during several weeks of quarantine before shipment from SEA.

The Lackland Dog Center likes to keep abreast of other problems confronting our modern world. By July first, twenty-five USAF marijuana-detection teams employing dogs were to have been graduated from a course recently added to the curriculum.



Air Force efforts to reduce aircraft accidents are paying off.

For the twelve-month period ended last December 31, the rate of major accidents involving aircraft declined to three per 100,000 flying-hours, the lowest in Air Force history. This com-

Fifteenth Air Force Commander Lt. Gen. Paul K. Carlton (left) accepts, on behalf of the Strategic Air Command, the Maj. Gen. Benjamin D. Foulois Memorial Award for the most effective aircraft accident-prevention program in 1970. Presenting the award from the Order of Daedalians, pilots of World War I, is Lt. Gen. James V. Edmondson, Deputy Commander in Chief of the US Strike Command.



Index to Advertisers

AiResearch Mfg. Div., Garrett Corp.	Cover 3
American Electronic Laboratories, Inc.	26
A.S. Barnes & Co., Inc.	31
Bunker Ramo Corp.	7
Collins Radio Co.	11
Colt Industries, Chandler Evans	
Control Systems Div.	23
Goodyear Aerospace Corp.	2 & 3
McDonnell Douglas Corp.	Cover 4 & 31
Motorola Inc., Government Electronics Div.	27
Northrop Corp.	28
Sperry Rand Corp., Sperry Flight Systems Div.	10
System Development Corp.	24
TRW Systems Group	Cover 2
Univac Div., Sperry Rand Corp.	1
Vought Aeronautics Div., LTV Aerospace Corp.	4
Westinghouse Electric Corp., Aerospace Div.	20

Aerospace World

pared to four accidents per 100,000 hours during the previous calendar year, for a twenty-five percent improvement.

To further emphasize the safety achievement, USAF points out that the major accident rate for aircraft in 1921 was 467 per 100,000 flying-hours, and twenty-one years ago, in 1950, was thirty-six per 100,000 hours.

While the definition of a "major aircraft accident" may have varied over the years since the first Wright flyer crashed, as would the cost in terms of lives and equipment, USAF folks have earned a "hats off" in the area of aircraft safety.



Since last September, when President Nixon ordered armed guards aboard commercial airliners to thwart skyjackings, more than 800 military personnel have served in that capacity.

In thanking the military sky marshals, all of whom are now replaced

by civilians especially trained for the task, Transportation Secretary John A. Volpe lauded the volunteers from the armed forces for adding "another proud chapter to their long traditions."

DOT first drew sky marshals from FAA, the FBI, the Customs Bureau, IRS, and the Secret Service, but when this manpower pool was deemed insufficient over an extended period the military was called upon.

Civilian sky marshals began graduating from the Treasury Department's four-week Air Security Officers School late in December at the rate of sixty per week.

To administer the program, and spur the effort against air piracy, the Office of Civil Aviation Security, headed by Lt. Gen. Benjamin O. Davis, Jr., USAF (Ret.), was set up and placed directly under the Secretary of Transportation.



NEWS NOTES—Lt. Col. Roy L. St. Martin, a SAC SR-71 recon pilot, has won the **1970 Koren Kolligian, Jr., Trophy** awarded annually for performance during an in-flight emergency. At 72,000 feet doing Mach 3 when stability systems failed, his skill saved the aircraft.

AFA member **Col. Everett G. Hobson, USAF (Ret.)**, has been appointed **Special Assistant for Drug Abuse Control** to Assistant Secretary of Defense (Manpower and Reserve Affairs). He'll coordinate military and federal agency programs fighting the drug problem.

Astronaut James A. Lovell, Jr., a Navy captain and veteran of four spaceflights, was named **Deputy Director of Science and Applications** at NASA's Manned Spacecraft Center, Houston.

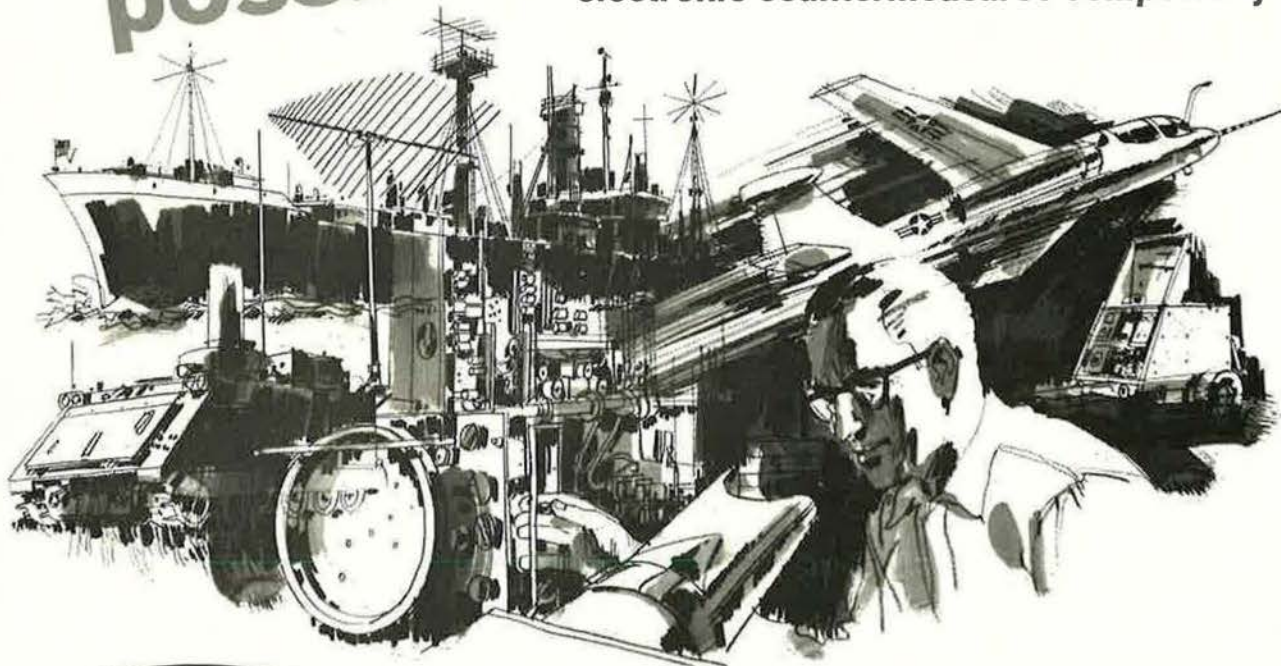
The **63d Military Airlift Wing**, Norton AFB, Calif., swept all five unit trophies at the **3d Annual Combat Airlift Competition**, Charleston AFB, S. C., late in May.

Igor Sikorsky, aviation pioneer, in May received the **Gen. Thomas D. White National Defense Award** given annually by the Air Academy to an individual who has contributed significantly to national defense.

Died: **Audie Murphy**, the most decorated US soldier of World War II, in a small plane crash in Virginia. He was forty-six.

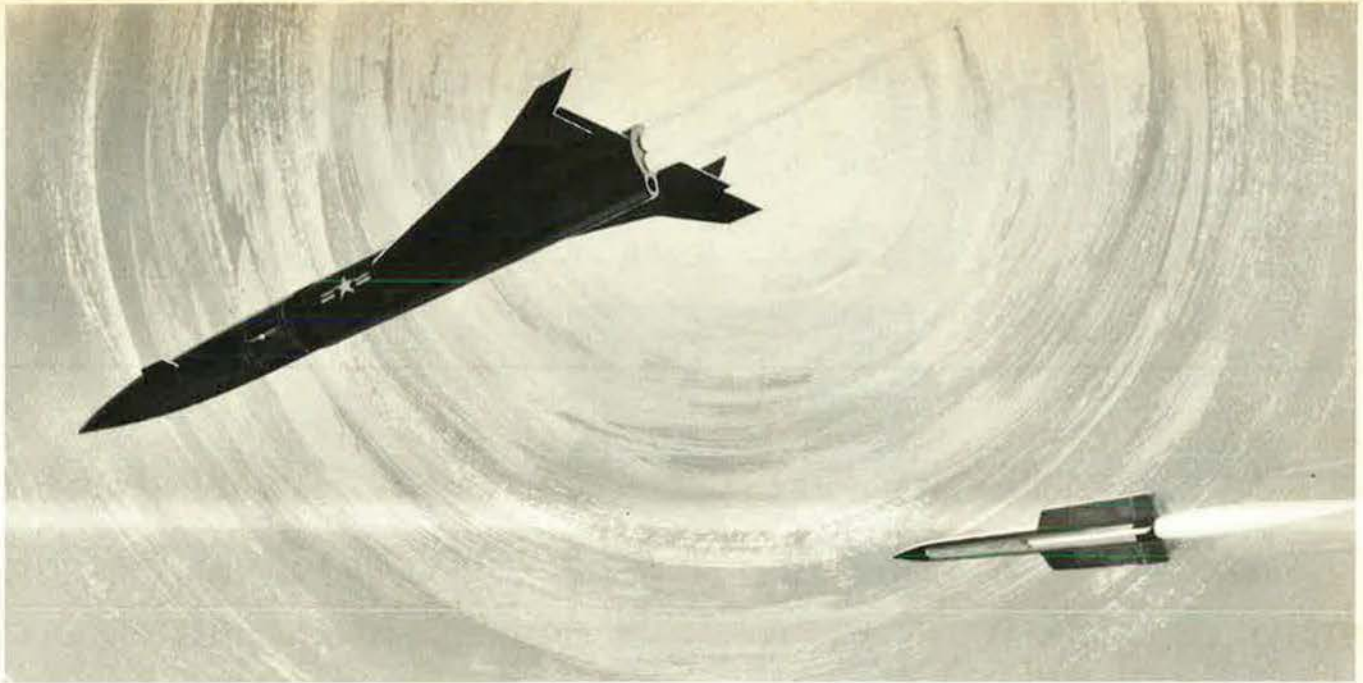
Died: **Maj. Gen. Richard O. Hunziker, USAF (Ret.)**, and his wife, **Margaret**, in a small plane crash in California. ■

mission possible with AEL's total capability in electronic countermeasures competency

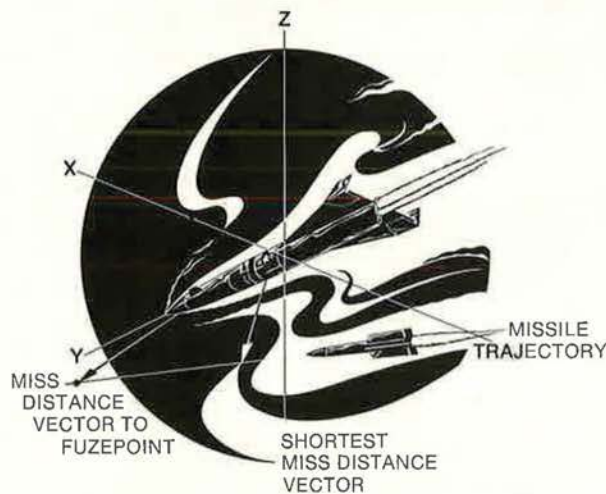


Write to Vice President of Marketing for additional information.

AMERICAN ELECTRONIC LABORATORIES, INC.
P.O. Box 552 • Lansdale, Pa. 19446 • (215) 822-2929 • TWX: 510-661-4976 • Cable: AMERLAB



hit?



A unique Vector Miss Distance Indicator (VMDI) can give you the answer during critical missile tests. Results are no longer a hit or miss situation.

This new Motorola system lets you compare exactly how a missile reacts against targets at various altitudes and airspeeds. Unlike other systems, VMDI establishes the trajectory of the missile relative to the target as well as the range and angle vector to the missile as it passes. Another plus is the position of

the missile at the instant of fusing. Scoring information is available from 0 to 200 feet. With this system you can determine if "misses" are random or if a set pattern is developing.

The airborne sensor can be linked to a computer on the ground through Motorola's Integrated Target Control System (ITCS) or through a number of other telemetry links. The VMDI system eliminates the guesswork with a direct printout of all scoring information. Tape readouts as well as plotter or CRT displays can be provided. Static tests of the system are now being conducted at an Air Force facility.

For information contact Motorola Government Electronics Division, Radar Operations, 8201 E. McDowell Rd., Scottsdale, Az. 85252 (602) 949-3172.



MOTOROLA

The T-38. It's been flying since 1580.



The T-38 Super-sonic Trainer is now observing its 10th Anniversary with the U.S. Air Force. Over 20,000 Air Training Command student pilots have chalked up 3.1 million hours in the jet — equivalent to one T-38 flying continu-

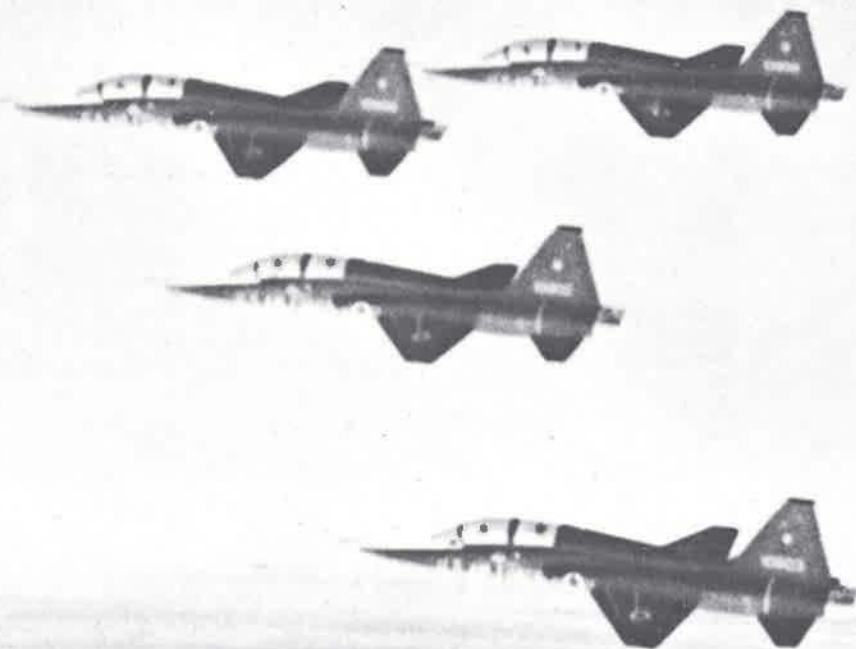


ously since 1580.

Also flown by the German Air Force, NASA's Astronauts

and the U.S. Navy, the T-38 has the best safety record of any super-sonic jet. All T-38s have been delivered on or ahead of time, at promised costs. And no change of design has been required.

NORTHROP



The Why of SEA Involvement

Roots of Involvement: The US in Asia 1784-1971, by Marvin Kalb and Elie Abel. W. W. Norton, New York, N.Y., 1971. 336 pages with index. \$8.95.

Marvin Kalb and Elie Abel have written an interesting and valuable book covering America's involvement in Southeast Asia, particularly in Vietnam. The title is somewhat misleading. Although the authors briefly cover early US relations with Asia, this coverage is superficial and could have been included in an introduction.

Beginning with Chapter Three, which is outstanding, the authors discuss the interactions and roles played by key individuals in the formation of American Southeast Asian policy. In describing the impact that the cold war, Kennan's containment policy, Joseph McCarthy's attacks, and the Korean War had on the steadily increasing involvement of the United States in Indochina, the authors make a major contribution in helping the "average" American understand early US commitments in that part of the world.

Continuing in a chronological manner, the authors discuss the major steps taken by the United States in Southeast Asia, concluding with President Nixon's decision to send troops into Cambodia. Throughout this period, the roles played by individuals with familiar names—Dean Acheson, John Foster Dulles, Dean Rusk, Robert S. McNamara, Maxwell Taylor, and Clark Clifford—as well as those not so familiar are presented. Also issues such as JFK's inability to make firm decisions regarding Laos and Vietnam, LBJ's "obsession" with continuity and "loyalty" among his cabinet members and his reasons for not seeking reelection in 1968, and Nixon's "fear" that led him to send troops into Cambodia are discussed. Kalb and Abel make their greatest and most worthwhile contribution in the discussion of the roles of these key people, and their parts in the formulation of United States policy with regard to Vietnam.

The primary weakness of this book is the lack of documentation of the many controversial issues discussed. At a time when most Vietnam-related decisions have been widely criticized,

any book that explains the "why" and "who" of these decisions must be thoroughly documented if it is to have lasting value. This is not to say that the authors' interpretations and explanations are not correct, but rather that they will have to stand or fall on the reader's evaluation of the authors' credibility. Nevertheless, this reviewer believes that Kalb and Abel have made a major contribution to the ever-increasing body of literature on US involvement in SEA. The more information, interpretive and factual, that is made available to the American people, the better will be their understanding of a very complex present-day issue.

—Reviewed by Maj. James R. Pralle, USAF, former member of the USAF Academy Department of History. Major Pralle is now a student at the Defense Foreign Language Institute, Monterey, Calif.

AIAA Award Winner

Vanguard: A History, by Constance McLaughlin Green and Milton Lomask. Smithsonian Institution Press, Washington, D. C., 1971. 257 pages plus notes, appendices, and index. \$12.50.

This meticulously researched volume, its dust jacket notes, is the first winner of the American Institute of Aeronautics and Astronautics' History Manuscript Award. Its authors (Mrs. Green's *Washington, Village and Capital, 1800-78*, won the 1963 Pulitzer Prize) clearly deserve such kudos. They interviewed or corresponded with many of the participants in the development of what was intended to become the first US earth satellite, and they made good use of much basic source material, especially from the Naval Research Laboratory, which had prime responsibility for Vanguard.

Vanguard: A History does not make for easy reading. This is understandable enough because the elements of the story are indeed complex. There is much about Project Vanguard that remains controversial, and the authors have made a determined effort to provide the basis for sound judgments.

The Foreword by Charles A. Lindbergh is enormously valuable. In a very few words, he once again demon-

strates his ability to focus upon underlying values, this time upon the elements of human accomplishment in fulfillment of an American commitment to the International Geophysical Year. For example: "Herein is portrayed both the genius and the ineptness of our American way of life. On the one hand, Vanguard history rests proudly with outstanding accomplishments; on the other, it clearly emphasizes how much more could have been accomplished through inter-service cooperation and support that was withheld." And again, in his explanation of why the Air Force, with the great potential of its Atlas booster, concentrated upon development of the ICBM: "There would be time to orbit satellites after our nuclear-warhead missiles were perfected and adequate marksmanship achieved."

In one particular, this definitive and exhaustive account of the successes—and the failures—of the Vanguard project is something of a disappointment. Its writing is so lean and sparse that the principals of the drama fail to achieve the flesh-and-blood "living-color" status they deserve.

For contrast, read Kurt Stehling's "I-was-there" account, *Project Vanguard*, published in 1961. Notwithstanding, the scholarly Green-Lomask effort stands in every respect as worthy of inclusion in the NASA historical series, and the Smithsonian Institution may take much satisfaction from the support it provided to make possible its execution.

One must agree with Lindbergh when he gives a "well done" to this book.

—Reviewed by Walter T. Bonney. Mr. Bonney, who recently retired as Director of Information for the Aerospace Corp., is the author of the 1962 book *The Heritage of Kitty Hawk*, published by W. W. Norton.

What Is Patriotism?

Patriotism in America, by John J. Pullen. American Heritage Press, New York, N.Y., 1971. 235 pages. \$6.95.

Ever wonder about a good definition for patriotism? How about: "It is love of country and readiness to act in its best interests as indicated by individual conscience and judgment"?

Airman's Bookshelf

John Pullen, author of the first truly comprehensive book on this elusive subject, provides the above definition and says the last four words—individual conscience and judgment—are the key ones. In describing how the attitudes of Americans toward their country have changed during the past 200 years, and discussing to whom and what thoughtful Americans should be loyal today, Mr. Pullen believes those four key words describe the real difference. "Under these terms, an effective fighting force can only be derived from a population which supports the military aims of the country, and these, under the Constitution, are determined by our civilian leaders."

A remarkably objective book that does not spare the military from criticism, *Patriotism in America* makes a strong point of the fact that the armed forces, operating under conditions where they could not possibly win, are being blamed unfairly for a situation that is largely the result of failures of civilian officials.

Deploring current euphemisms, Mr. Pullen writes that airmen and aircraft have come to have curious meanings. They are not "combat troops" in the sense of infantrymen, although a flyer who has had his plane riddled by ground fire might not agree with this concept.

A combat serviceman himself during World War II, with revolutionaries among his forebearers, Mr. Pullen covers a wide spectrum of subjects, including the proposed volunteer force, the draft, the role of the conscientious objector, attitudes of soldiers in the field, effect of national commitments on public opinion, and the behavior of Americans during successive national crises.

Looking back into history, he shows how Abraham Lincoln had his "Tonkin Gulf" and James Madison "his war," just as have Presidents Johnson and Nixon. He traces the draft back to its inception during the Civil War and concludes that "For a military activity the public supports, a draft is accepted as a necessary evil and endured or even highly favored, but for an activity the public does not support, the draft is relentlessly attacked."

The chief interest of this book to those in high levels of military command, as well as to the armed forces generally, is in the fact that it is a thoroughly researched and wholly ob-

jective appraisal of the resources of patriotism that are available to support the nation's current schedule of foreign commitments.

Mr. Pullen is also the author of *A Shower of Stars: The Medal of Honor and the 27th Maine*.

—Reviewed by Flint O. DuPre,
Office of the Secretary of the
Air Force, Hq. US Air Force,
Washington, D. C.

The Military in Africa

Spear and Scepter: Army, Police, and Politics in Tropical Africa, by Ernest W. Lefever. Brookings Institution, Washington, D. C., 1970. 251 pages with index. \$6.50.

How can newly emerging nations that inherited a desire for self determination, but who achieved independence without adequate training for self government, develop into modern, politically viable states? Professor Lefever suggests that, as long as the post-colonial central political symbols and institutions in Africa are weak and lacking in cohesiveness, the politics of force will supersede the politics of persuasion.

The role of the military and police services in less-developed nations is thoroughly examined in an extremely well-documented volume containing three case studies of diversified African countries. The author shows that the scepter, as a symbol of political authority, must be upheld by men who wield the spear. Mr. Lefever clearly illustrates that the army and police are the most integrated, detribalized, and cohesive institutions in their countries. Even a small, well-organized army or police force can exert strong political influence by supporting or resisting the existing regime.

The interrelationship of the military and police forces with political processes is examined in the light of domestic and foreign policy, as well as nation-building. The apolitical military and police forces created by the colonial powers, now led by an Africanized officer corps, provide the centripetal forces to counter centrifugal tribalism, regionalism, and multiparty forces.

Lefever's analysis of the three case studies concludes with several hypotheses supporting his contention that most armies have a moderating influence on foreign policy in newly emerging nations, largely because of their traditional institutional stability.

A final chapter examines influence of Western (particularly US) assistance on the military and police forces. Although over two-thirds of US assis-

tance has been channeled to eight priority nations, the political behavior of their military and police forces has been influenced more by internal forces than by external aid.

This is the most perceptive book on the subject available today.

—Reviewed by Maj. Giles D. Harlow, Jr., Assistant Professor of Political Science, USAF Academy.

New Theory For Policy-Makers

The Limits of Coercive Diplomacy: Laos, Cuba, Vietnam, by Alexander L. George, David K. Hall, and William E. Simons. Little, Brown, Boston, Mass., 1971. 268 pages with index. \$7.95.

The reader who turns to *The Limits of Coercive Diplomacy* expecting to find something new will be disappointed. The objective of the book's three authors was not only an examination of problems in order to contribute to better decision-making, but also to add to the corpus of international-relations theory. Their success is mixed. On the one hand, their listing of various preconditions for coercive diplomacy, and the various stages through which a policy-maker can move, might be valuable to decision-makers. But even then, several of their most vital preconditions for the success of coercive diplomacy are dependent on the opponent's perception of the situation, something that is very difficult for the decision-maker to control.

As to their formulation of a new policy-relevant theory, that is harder to judge. They have only used three case studies in any depth, and a few others superficially. What is needed to establish their claim to theory formulation are many in-depth studies of coercive diplomacy, not limited to the United States. Both sides of the conflict, moreover, must be studied to see if the perceived variables are, in fact, perceived by both sides.

The chapters on Cuba and Laos do not rise much above a rehash of the writings of Arthur Schlesinger, Jr., Robert Kennedy, Townsend Hoopes, and Roger Hilsman. In fact, it is distressing to see the increasing reliance on memoirs written by active participants in the events of the last decade. While it is true that many valuable insights may be gained from the vast number of personal recollections of the Kennedy-Johnson era now flooding the market, it is vital to remember that the men writing them are anxious to justify their own activities and, more so than most, are concerned

with what history will think of them. Political scientists believe memoirs; historians tend to be more skeptical.

The chapter on Vietnam presents nothing new. But what it does do, and very vividly, is something most of us have forgotten or chosen to overlook. Nowhere does the supposedly Johnsonian style of shooting from the hip and thinking later come out. As Air Force Colonel Simons demonstrates, President Johnson was extremely reluctant to use force to achieve the vague and conflicting goals of United States policy in Vietnam.

In fact, to some of his advisers the President appeared overly cautious. Reluctantly, and only under pressure from both his advisers and his opponents, domestic and foreign, did Johnson's strategy of limited air strikes in the north develop. It was apparent that "Hanoi . . . interpreted United States restraint as a lack of will." Since President Johnson did not want to intervene massively in Vietnam in early 1965, the only clear military option left to show his resolve was "limited air strikes in the north."

—Reviewed by Capt. Louis M. McDermott, Assistant Professor of History, USAF Academy.

New Books in Brief

Aircraft of the Royal Air Force Since 1918, by Owen Thetford. This is the fifth edition of a standard reference work that first appeared in 1957. The volume includes pictures, drawings, technical data, and the manufacturing and operational histories of all aircraft operated by the RAF from 1918 to 1970. Missiles and gliders are covered in appendices. Putnam & Co., Ltd., 9 Bow St., London, England, 1971. 624 pages with appendices and index. £4.20.

Every War Must End, by Fred C. Iklé. The head of the Social Science Department of The RAND Corp. points out that wars are traditionally fought according to plans that do not include detailed thought about how they will end. After the fighting starts, new forces take command, often making it difficult to stop the fighting, especially in an unsuccessful war. This has serious implications in the nuclear era. Columbia University Press, New York, N.Y., 1971. 160 pages with notes, bibliography, and index. \$2.95 paperback.

Latin America Today and Tomorrow, by Galo Plaza. The author, a former President of Ecuador, now Secretary-General of the Organization of American States, analyzes the do-

mestic impact of Latin America's "revolution of rising expectations" and its relationship to US policy. A sixty-page appendix includes profiles of the Latin American nations. Acropolis Books, Washington, D. C., 1971. 240 pages with index. \$6.95.

Ryan the Aviator, by William Wagner in collaboration with Lee Dye. As the subtitle indicates, this is ". . . the adventures and ventures of pioneer airman and businessman T. Clyde Ryan." The authors trace the career of their subject from his start in aviation with a \$450 investment, through his experience as an airline operator, manufacturer of famous planes (including the *Spirit of St. Louis*), and into the missile and space age, when the Ryan Aeronautical Co. sold out to Teledyne. A large, interestingly written, and lavishly illustrated book. McGraw-Hill, New York, N.Y., 1971. 253 pages with index. \$18.50.

Soldiers, Scholars, and Society: The Social Impact of the American Military, by Edward Bernard Glick. A Temple University political scientist and occasional contributor to AIR FORCE Magazine examines a wide range of interactions between the US military and the social, political, and economic structure of the country. Professor Glick offers a number of suggestions for making the military—which he believes to be necessary in the foreseeable future—more compatible with overall national objectives, and for achieving more enlightened and objective civilian control of the military. Goodyear Publishing Co., Pacific Palisades, Calif., 1971. 144 pages with index. \$4.95 paperback.

United Nations Peace-Keeping Operations: A Military and Political Appraisal, by James M. Boyd. The author, a retired USAF colonel and former Chief of Staff, UN Military Staff Committee, discusses UN control of international conflict and its peace-keeping work. He compares and contrasts three such operations—Suez, the Congo, and Cyprus—discussing force creation, composition, organization, and command and control. Colonel Boyd offers suggestions for improving the effectiveness of peace-keeping forces. Praeger Publishers, New York, N.Y., 1971. 261 pages with index. \$15.

Two 1971 additions to Ballantine's Illustrated History of the Violent Century series are: *Stilwell*, by D. D. Rooney, and *Guadalcanal Island Ordeal*, by Graeme Kent. Ballantine Books, New York, N.Y. Both books 160 pages. \$1 each, paperback. ■



"Ride" with the *Thunderbirds*

The thrill of a flight with the USAF Thunderbirds is captured in a new color motion picture, "Ambassadors in Blue." Special onboard cameras put you in the heart of the five jet formation of Phantoms as they wheel through a spectacular air demonstration. Original background music features Air Force Academy Falconaires.

A number of 16mm prints are available on loan for showing at industrial or civic meetings, or other gatherings of aviation enthusiasts. Running time is 15 minutes. There is no charge if film is returned in one week. Send request on company letterhead. Include date desired for showing, an alternate date, and the name of the organization to which the film will be shown.

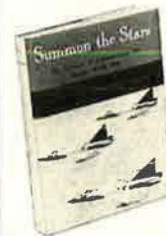
Mail to:
"AMBASSADORS IN BLUE"
MCDONNELL DOUGLAS
BOX 14526
ST. LOUIS, MISSOURI 63178



The Book You Can't Afford to Miss!

SUMMON THE STARS

By Joe Christy
and Page Shamburger



The exciting story of America's airmen and aircraft — both military and civilian — from 1939 thru moon landings. Vividly depicts in words and 376 photos our fabulous aerospace heritage. Covers rise and development of commercial aviation, private and business flying, sport aviation. Contains a complete list of every manned space flight, Russian and American, plus the history of modern rocketry from Goddard's earliest experiments to Saturn V. Recreates man's boldest dreams and his greatest adventures.

\$20.00

A. S. Barnes & Co., Inc., Dept. AF771
Box 421, Cranbury, N.J. 08512

Please rush me copy(ies) of "Summon the Stars" @ \$20.00 per copy. Enclosed is my check or M.O. for \$.....

Name

Address

City State Zip

During the past three decades, scientists and engineers—in uniform, with industry, and in university laboratories—have combined talents and facilities in the field of electronics to give the Air Force operational, planning, and management capabilities that were in the realm of science fiction at the start of World War II. The widespread use of electronics, accelerating most rapidly since the mid-1950s, has created . . .

USAF's Electronic Revolution

By John L. Frisbee

SENIOR EDITOR, AIR FORCE MAGAZINE

IF THE Army Air Forces had suddenly been deprived of all existing electronic equipment at the start of World War II, it could have continued to operate as a fighting force. Its combat capability certainly would have been reduced, but it would not have gone out of business.

Today, without its electronic systems, the USAF literally could not get off the ground. There is no major activity in the Air Force that isn't totally or partially dependent on electronics. Within the service life of many airmen who are still on active duty, the USAF has become an electronic air force.

The trend toward reliance on electronics was firmly established during World War II. By V-E Day, the AAF was using a fairly wide range of electronic equipment, including radar for traffic and operational control, microwave airborne radar, and Loran—a long-range radio navigation system. The B-29 was heavily dependent on electronics. Development of radar bombsights was under way. The AAF had become the major service investor in research and development, much of it in the field of electronics. Between 1939 and 1944, the AAF was responsible for no less than twenty-five percent of all money spent by the federal government for R&D. After October 1944, the development of radar for air operations was transferred from the Army's Signal Corps to the AAF.

According to Dr. Theodore von Kármán, Director of the AAF Scientific Advisory Group, the US ended the war in Europe with a two-year lead over Germany in the field of radar. This he attributed to close coordination between the military, industry, and university scientists—a triumvirate that in those days was hardly considered sinister.



The British were the first to get an operational radar system to the field. These 360-foot-high masts were part of the radar net that was instrumental in winning the Battle of Britain.



Electronics—from the Middle Ages to the Age of Aquarius in less than thirty years. At left, a Civil Defense Filter Center at Los Angeles in 1943. Right, NORAD's Space Defense Center, deep inside Cheyenne Mountain near Colorado Springs, Colo., receives data from a network of electronic space-watching devices.



By mid-1945, the US military services had nearly \$3 billion worth of radar equipment in combat use. Despite this tremendous expansion in one area of electronics, radar techniques were still in their infancy. With the equipment then available, the AAF was still unable to achieve two long-sought objectives—true all-weather operations and consistently precise delivery of ordnance by either strategic or tactical aircraft. These were still distant goals for the scientist, engineer, and operational planner.

The Von Kármán Reports

In August 1945, Dr. von Kármán's Scientific Advisory Group prepared a paper, "Where We Stand," for Gen. Henry H. Arnold, Commanding General of the Army Air Forces. Among observations on the future of military electronics, the report noted that R&D planning would have to consider as fundamental realities that:

- "Due to improvements in aerodynamics, propulsion, and electronic control, unmanned devices will transport means of destruction to targets at distances up to several thousand miles;
- "Defense against present-day aircraft will be perfected by target-seeking missiles;
- "A perfect communications system between fighter command and each individual aircraft will be established;
- "Location and observation of targets, takeoff, navigation, and landing of aircraft, and communications will be independent of visibility and weather."

"The air force of the future," Dr. von Kármán foresaw, "will be operated so that radar is the *primary* facility, and visual methods will be only occasionally used. The whole structure of the air force, the planning of its operations, its training program, and its organization must be based on this premise. The development and perfection of radar and the techniques for using it effectively are as important as the development of the jet-propelled plane."

At General Arnold's request, Dr. von Kármán had prepared an earlier and more widely known report, "Toward New Horizons," which was completed in November 1944. The report contained recommendations on the most fruit-

ful research areas, and on the organization and funding of Air Force research and development. Of the eight major research areas analyzed in the report, six were keyed to advances in electronics, and the other two were at least partially dependent on electronic innovations.

Dr. von Kármán noted that ". . . the amount required for [all AAF] research and development should constitute 25–33 percent of the total Air Forces budget." He believed it essential that ". . . research and development in the fields of aerodynamics, propulsion, control, and electronics should function as one entity"—a forecast of the systems approach to R&D that is standard practice today.

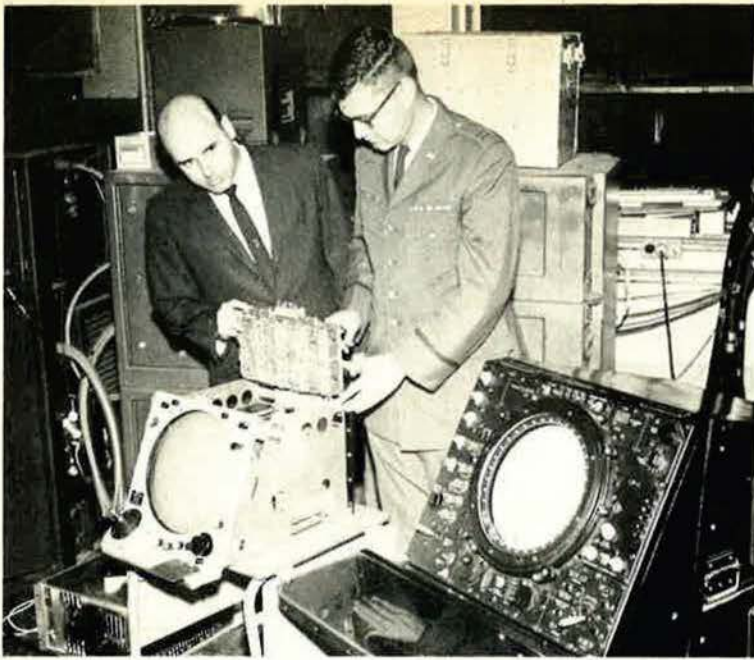
Electronics and Nuclear Strategy

During the first fifteen years of the post-World War II period, defense strategy was dominated by nuclear weapons. Electronics applications in the operational forces were oriented principally toward strategic offensive and defensive systems in the widely held belief that strategic nuclear superiority would deter both intercontinental nuclear war and limited conventional wars.

Major emphasis in electronics was on systems for warning of attack against the continental United States—first by bombers, then by both bombers and missiles—interception and destruction of attacking aircraft, penetration and destruction of enemy defenses by USAF strategic bombers, and delivery of nuclear weapons with an accuracy that was compatible with their lethal radius. Electronic warfare (spoofing, jamming, and tapping the enemy's radars and communications systems), which had grown out of its infancy during World War II, became a highly developed branch of electronic application, with specialized equipment and trained operators in the fields of electronic countermeasures (ECM) and electronic counter-countermeasures (ECCM). Electronic intelligence (ELINT), both ground-based and airborne, soon was able to gather such a volume of intelligence that it could be managed only with the help of computers.

Early in the postwar period, SAC began developing its worldwide command and control





The seventy-pound integrated circuit MIRAGE (Micro-electronic Indicator for Radar Ground Equipment), developed by General Electric Co. for Rome Air Development Center, replaced a 600-pound unit.

system, initially ground-based but later supplemented by Looking Glass, the airborne command post that has evolved into a system able to control the entire SAC force of bombers and missiles if the SAC command post at Omaha and its alternates were destroyed.

The key to maximum exploitation of both ground-based and airborne electronic systems was the computer. Early computers were mammoth affairs with thousands of vacuum tubes, requiring large power sources for operation and cooling. With the introduction of transistorized, integrated circuits in the mid-1950s, computers could be reduced in size and power requirements by several orders of magnitude. This opened the door to airborne computer applications, and to the substitution of the more flexible digital computers for earlier analog computers that had provided "canned" answers to navigation and weapon-delivery problems, but not the ability to adjust rapidly to changing operational situations. The computer thus became one of the two major building blocks on which the operational use of sophisticated electronics rests. It was an offshoot of missile development, the first airborne digital computer having been used in the Snark missile.

The second major building block also came from missileery. It was the inertial platform, first perfected as a guidance mechanism for long-range missiles, and now used as a navigational reference system in many types of aircraft. Inertial systems are now capable of long-range navigation with an error factor well below one mile per hour of flight time. The inertial platform, coupled to an airborne digital computer,

provided a hitherto unattainable flexibility and accuracy in navigation and weapons delivery.

Refinements in miniaturized digital computers and inertial platforms have, within a decade, improved the accuracy of intercontinental missiles by a factor of about twelve, and missile reliability by perhaps ninety-five percent.

TAC Goes Electronic

For about fifteen years after World War II, the development of electronic systems specifically for tactical aviation had a much lower priority than did electronics applications in the strategic offensive and defensive areas. Air-to-air gunnery, for instance, advanced little between 1945 and 1965. Visual bomb-delivery accuracy of tactical fighters was not significantly better in 1965 than in 1945, in part because of the emphasis on tactical nuclear weapons that did not require very small CEPs (circular error probability).

In the early 1960s, President Kennedy's desire for a wider range of military options led to a resurgence of high-level interest in, and an expansion of, tactical airpower. Relatively little had been done since the early 1950s to tailor tactical air forces for limited conventional war—particularly for the kind of air war to which the USAF soon would be committed in Southeast Asia.

In the mid-'50s, the annual Air Force budget for R&D in conventional ordnance and armament dropped to a low of \$460,000. By 1966, it had increased by a factor of 160, to about \$76 million, and the number of people working in this field had increased tenfold. The Air Force was managing more than 700 R&D programs in the limited war area.

For example, Shedlight, the overall program



The B-52, shown here with two Hound Dog missiles, has been able to accept the increased volume, weight, and power requirements of new electronic systems, thus extending its operational life.

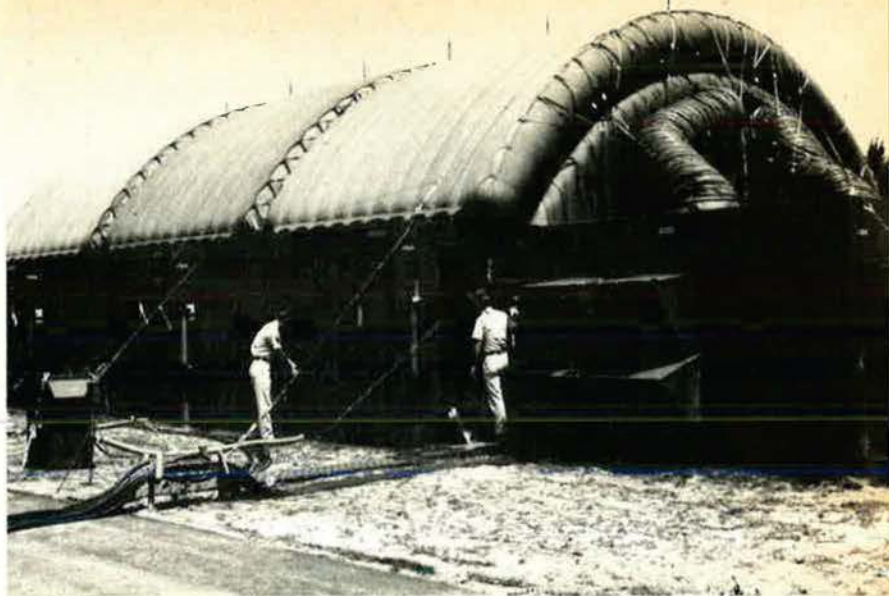
for improving the night and bad-weather capability of tactical fighters, gunships, and forward air controllers, included some 150 individual programs, many of them in the area of electronics.

During the past five or six years, there has been an unparalleled increase in new electronic equipment for tactical aircraft, or in the adaptation of electronics from other mission areas. Perhaps a bit unfairly, it has been said that the people in TAC have learned what SAC has been talking about.

Among the electronic improvements and innovations in the tactical area have been better electronic devices for low- and high-level navigation, and for locating targets at night and in weather; computer-directed systems that allow the pilot to deliver weapons accurately while maneuvering; head-up displays that let the fighter pilot read his scopes without keeping his head in the cockpit; fighter-borne electronic warfare (now called electromagnetic warfare) systems, both active and passive; near real-time reporting of reconnaissance information; a wide range of sensors that penetrate cloud and darkness; and more flexible and comprehensive command and control systems.

Loran C and D, refinements of the World War II radio navigation system, are now accurate enough, when coupled with digital computers, to direct blind bombing of all but hard targets by high-speed aircraft. Computer-directed guns and "smart" bombs—bombs that are guided by laser beams, television, or other electro-optical means—have revolutionized the accuracy of conventional ordnance delivery.

An example will show the importance of improved bombing accuracy. With a CEP of 350 feet—probably a good average for conventional bombs delivered visually by tactical fighters against a moderately defended target—it could take as many as 200 sorties to achieve a .85 probability of destroying a medium-size iron bridge. With a sixty-foot CEP, only nine sorties would be needed. With the CEPs achievable by laser-directed smart bombs—ranging from zero to a few feet—only one sortie might do the job. The reductions in personnel and equipment losses, logistics requirements, and other operating costs resulting from accuracy, and the ability to launch a guided bomb or rocket from outside the enemy's anti-aircraft defenses, are obvious. In a period of reduced military budgets and probably of smaller force structures, an improvement of



Developed by AFSC's Electronic Systems Division, this Aircraft Control and Reporting Post is part of Tactical Air Command's highly mobile complex of radars, computers, and communications equipment.

this magnitude in operating effectiveness could spell the crucial difference between sufficiency and inadequacy in our combat forces.

With the current wide application of electronics to tactical aviation—and also to airlift—the USAF has become operationally a truly electronic Air Force. It is close to a cherished goal—a self-contained airborne capability to locate targets in any weather, and destroy them in one pass.

Manpower and Money

Computer technology, in some cases associated with sensors and sophisticated communications, also has pervaded and revolutionized the support fields—logistics, personnel management, research and development, intelligence, aviation medicine, training and education, cartography, accounting, budgeting, and planning. In all these areas, and in operations, too, the capacity of electronics to extend man's senses and to supplement his intelligence challenges the imagination of the commander and the manager.

Some measure of the importance of electronics to the Air Force may be found in terms of the dollars and manpower dedicated to the electronics field. More than 12,000 officers and nearly 110,000 airmen are trained for and assigned to some phase of electronics activity. That works out to about one of every six active-duty blue-suiters. Twenty-one thousand civilian employees of the Air Force are electronics specialists.

The Air Force offers 905 in-house training courses in the electronics area. More than 500 of these courses are conducted at technical



This lightweight, air-transportable, solid-state electronics radar weighing less than 600 pounds can be set up in thirty minutes. It was developed by Rome Air Development Center to detect low-flying, high-performance aircraft.

training centers, with the remainder provided by using agencies at their own installations.

It is estimated that the Air Force now owns and operates more than \$8 billion worth of communications and electronic equipment, exclusive of ground-based computers. No figure is available for the value of ground-based computers since many of them are leased from the manufacturers. Unofficial guesses run as high as \$5 billion.

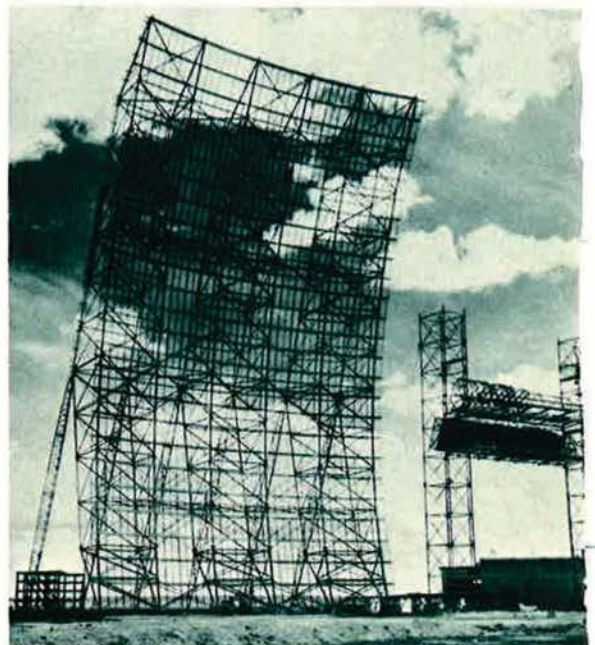
Although it varies widely, depending on the purpose for which an aircraft is designed, about one-third the cost of a new manned weapon system goes for electronics, on the average. In missiles, electronic components may run as high as fifty percent of the cost, and in space systems—exclusive of boosters—higher than that. About a third of Air Force Systems Command's exploratory work not aimed specifically at developing new systems is in the field of electronics.

Any new aircraft that does not have the

potential for accommodating more—and more sophisticated—electronic gear will soon become obsolete at worst, or limited in its capability at best. The B-58 is a good example of an aircraft that was retired early, partly because it lacked the space for stowing additional electronic systems and the power sources they require. Fortunately, the larger B-52 has been able to handle electronic systems growth—at least up to this time. The F-4 has reached the limit of its capacity. New electronic gear can be added only if existing onboard equipment is removed.

The need for adaptability of new weapon systems to electronics growth has been recognized in the design of the major manned systems that now are in various stages of development—the B-1, F-15, A-X, and AWACS. All should be able to accommodate the volume, weight, and power requirements of new or improved electronic systems that are likely to reach operational status during the lifetime of these aircraft.

Research and development people believe that across-the-board application of electronics has put the Air Force in a better position to look ahead than ever in the past. In whatever direction they look, they see an expanding use of electronics. It is a permanent revolution—this revolution that in three decades has made USAF an electronic Air Force. ■



From the very start, man's exploration of space has rested on a foundation of electronics that allowed men to see and to act, whether they were physically present or not. This 1955 radar was the first designed for space surveillance.

THE ELECTRONIC AIR FORCE

Cost and complexity—these are the two prime factors in the irrevocable trend toward ever-increasing utilization of electronic systems in the US Air Force. The electronic future of the Air Force is open-ended, depending only on the willingness to expand the pool of fundamental research data through vigorous research and to fund the development of needed feasible systems . . .

USAF's Electronic Future — Open-Ended

By William Leavitt

SENIOR EDITOR, AIR FORCE MAGAZINE

THE ELECTRONIC shape of Air Force things to come? These are among the possibilities: complete and precise spaceborne surveillance and warning of missile attack against the United States; nearly total automation of tactical command and control in the field; computers that will "understand" queries presented in English and will "answer back" in English; an all-digital worldwide communications system; new techniques of converting electromagnetic energy to other forms of energy and storing it for future use; a solution of the communications blackout problem during certain portions of hypersonic flight; personal minicomputers for field use; computers that "talk" to each other; and the relay, via vast high-capacity, secure underground "light" pipes, of laser-borne communications.

All these potentials for the Air Force of the future—and the list is scarcely complete—are foreseeable on the basis of existing or developing knowledge. Some are, to one degree or another, already in actual research and development. Whether they all come to fruition will depend largely on two factors: whether it is judged that they are really needed and, if so, whether the Air Force will be able to convince higher authority, and the legislators who supply the money, that such hardware and software are needed.

Today's US Air Force, already deeply committed to the operational use of the electronic arts, is headed irrevocably, during the coming decades, toward an even more pervasive electronic future in which an ever-increasing number of military tasks will be performed directly by or with the aid of electronics-based devices and systems.

This does not mean that the Air Force of the 1980s and 1990s will be a totally automated, "people-free" organization. But it does mean that tomorrow's Air Force, by sheer necessity, will have to link even more tightly the flexibility and perception of the human mind with

the incredible speed and enormous capacity of electronic systems in order to perform the array of day-to-day and emergency tasks that are the responsibility of the Air Force.

Cost and Complexity

The reasons for this projection are simple, and they both begin with "c"—complexity and cost.

In peace or war, or in the seemingly never-ending environment of partial alert we live in, there is a constant Air Force need to gather, collate, filter, relay, and display in accurate, credible, and, above all, useful form vast quantities of information on which decisions and actions are based. Such decisions run up the scale



Clear display of data and the ability to edit are crucial to decisions. This Rome Air Development Center engineer is using a light pencil to edit data. Situation display shows a simulated situation.

of importance from the mundane to the cosmic. The correct electronic calculation and delivery of an airman's pay package, for example, may be of immediate significance to the airman more than to anyone else. But there are vastly more complicated kinds of decisions that, to an increasing degree, are based on electronically sensed and relayed data. The same electronic technology fires both kinds of operations.

Men's lives in combat will increasingly depend on the correct organization of electronic systems. The nation's life itself could hang on the same technology. No one can abolish the possibility that, on some grim future day, a President, on mercilessly short notice and with millions of lives in the balance, will have to decide in only minutes whether and *how* to unleash this country's retaliatory power. If he is to have any chance of making that decision in the best interests of the nation, he will have to have at his instant disposal a precise and credible estimate of the military situation. And his estimate will have been largely electronically sensed, filtered, communicated, and displayed to him.

It should be pointed out, too, that, even if peace should "break out" in terms of a viable arms-control agreement between the major powers, the electronic requirement will still be sizable, in view of the need for continuous surveillance and warning of violations, as well as inspection.

So much for "c-for-complexity," although pages more could be devoted to the theme. The other "c" that makes increased use of electronics inevitable is "c-for-cost." The fact is that as the complexity of the Air Force mission has grown, so has the cost of operations. The cost is largely the cost of paying people, more and more people. The number of people required to do the enormous number of jobs required by a modern, global, Air Force is staggering. Ironically enough, some of the jobs include the very tending of the electronic and other gadgetry of what is already a highly "electronicized" Air Force. More people cost more money. This is even more painful for planners in an inflationary period in which an increasing chunk of the budget has to go toward pay and allowances that cannot be denied if the military is to retain the people it needs.

The Survival Imperative

Putting it another way, the Air Force, like any other large organization with a multiplicity of tasks, simply has to find ways of doing more at less cost. The reasons go beyond the cost of people. The price tags of modern weapon systems are so high that losses amount to financial disasters. Airplanes and missiles costing millions of dollars per copy *have* to survive to perform their missions if there is to be any justification for laying out the money to build them in the



ESD has worked on an airliftable aircraft control tower that could be used on unimproved airfields in battle areas. This shot was taken during early testing of the concept, which proved out.

first place. And, again, ironically, a sizable proportion of the high price of today's weapon systems is run up by the cost of their onboard electronics and associated ground-based systems.

To all these factors must be added the present political environment of increasing public resistance to military expenditures in general.

The twin problems of cost and complexity that afflict the Air Force these days can only be expected to trend upward. They are probably not totally solvable. But the people who worry about such matters in the Air Force—particularly the electronics people—are convinced that the imaginative, effective, and economical use of electronics in all its present and potential military applications can help mightily to ease the cost/complexity bind in the future.

One very important reason for their confidence is the fact that, as technology and experience have grown, the cost of electronics' basic components—particularly in the computer field (*see p. 44*)—are coming down. Also, as is evident to every owner of a transistor radio, the size and weight of electronic equipment is being reduced, which allows for savings in its deployment. Thus, it is possible to suggest, by way of example, that in years to come all the electronic hardware and software that will go into a system—such as the oncoming Air Force Airborne Warning and Control System (AWACS), which now must be carried aboard a specially outfitted Boeing 707-type aircraft—could be carried in smaller and less expensive craft. Not necessarily but possibly.

Again, it's important to stress that the idea of an increasingly electronic Air Force does not mean the elimination of people as the ultimate managers and decision-makers. It means, rather, fewer but even more skilled people, working at more complex tasks—with elec-



tronic systems making up the difference. Electronics will provide the ability to combine the slow but usually sure powers of the human intellect with the enormous speed and storage capacity of electronically based automatic systems.

Organized correctly—and “correctly” can mean different things to different experts—electronic devices, whether they are sensing data, or sorting it, or moving it, or displaying it, can do jobs ranging from computing pay and keeping track of spare parts to providing quite complex decisional alternatives to commanders at all levels. They can sense the terrain under an aircraft with sufficient accuracy to draw a video map for the combat pilot. Ground-based radars can watch for missile attacks from halfway around the world. Deployed in space, and using combinations of infrared and optical devices, there are systems that will observe and relay to earth, rapidly and with increasing accuracy, data on enemy missile activity.

There are devices in development that will allow a commander to speak normally into a telephone and have his spoken message “translated” into coded digital data that will then be reconstituted, at the other end of the line, into an understandable artificially produced human-sounding voice that will be recognizable as that of the original speaker. Such systems have not only military potential but obvious nonmilitary applications. For example, one can imagine the high civilian utility of another concept being looked at, at the Air Force Systems Command’s Electronic Systems Division at Hanscom Field, Mass. This is the Airborne Weather Reconnaissance System (AWRS), which would provide the USAF air weather people “real-time” weather data—sensed, computer-processed on-board, and then relayed to ground stations from aircraft over selected areas. The AWRS program, according to ESD, has recently been reoriented to emphasize quick tropical-storm reconnaissance.

Ending the Talkfest

Or, by way of another example of a concept also being studied by ESD, there is PLRACTA (Position, Location, Reporting, and Control of Tactical Aircraft). ESD is working with its nearby technical consulting firm, MITRE, on PLRACTA.

PLRACTA is a concept that would, once and for all, virtually eliminate constant wasteful dialogue between ground and air, all the voice transmissions and “say again’s.” The idea is to use digital communications, on a sequential basis, from air to ground, with each pilot having a broadcast position that belongs exclusively to him. Each pilot, in turn, would transmit information in a very short burst of coded signals. The transmission might take



Designed by the Rome Air Development Center, this forty-eight-pound radio pack provided enough communications equipment for one man in the field to operate a forward-control command post.

only a hundredth of a second during each "time slot." Ground control could, from its point of view, and according to its command and control needs, then, at any time, call down hunks of data—say, weapon load—from any aircraft in the group linked by PLRACTA. Voice override would always be possible.

Planners give this picture of PLRACTA at work, using the oncoming F-15 as an example. The aircraft's sensors linked to cockpit instruments would gather data on fuel supply, ordinance, aircraft location, speed, and heading. The data would be stored in a small airborne computer and transmitted during the particular aircraft's time slot, automatically and with no effort by the pilot. The tactical command and control center on the ground would continuously have current data on all its airborne aircraft. And if ground control wished to divert an aircraft, all it would have to do would be to flash a message to the aircraft, which would be received during that aircraft's time slot. The time slot would, of course, come up quite rapidly in view of the speed of the continuing broadcasting cycle.

The list of military tasks that might be accomplished electronically is open-ended. What will become practical is another question, the answer to which lies in the pace and quality of research. That in turn raises the policy question of whether current gutting of basic research in the military and in universities and industry is not a penny-wise and pound-foolish approach that could cost us dearly in the future. As experts at places like the Air Force Cambridge Research Laboratories at Bedford, Mass., a nearby neighbor and partner of ESD, point out, many of today's electronic systems are based on relatively old chunks of knowledge. It is not a self-serving cliché to suggest, then, that, unless fundamental research into the properties of matter and energy continues at a reasonable rate, the enormous potential of electronics for future military and civilian applications may never be realized.

ESD's Mission

Electronics is so pervasive in the Air Force today that, as ESD's Commander, Maj. Gen. Joseph J. Cody, Jr., points out, it "has no real home," that is, in the sense that all electronic developments can be described as being focused in one place in the Air Force. While this is true, the function of ESD at Hanscom Field, as it has evolved in the past decade, is as close to being a "home" as one can determine in these days of complex Air Force organization.

ESD's mission (see accompanying listing of principal projects) is conceptual development, system design and engineering, and acquisition of major electronic systems for the Air Force. Located not far from historic Lexington, Mass., where the first battle of the American Revolu-

tion took place on the still lovingly preserved village green, ESD's biggest ongoing project these days is AWACS, which represents a crucial exploitation of the relatively new "overland" radar technology that allows spotting of aircraft against the ground terrain. When it becomes operational, AWACS will largely neutralize an enemy's ability to underfly radar.

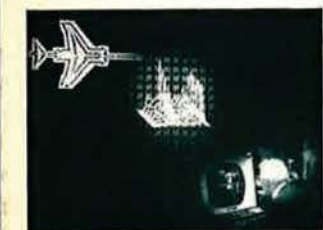
AWACS will also not only be able to track enemy action but also be able to command from the air the deployment of friendly aircraft without ground control, if necessary. It can also direct its own defense, by escorting fighters, or carry its own defensive weaponry. It could also be tied in with military communications satellites and with tactical control centers on the ground. The importance of the AWACS project is illustrated by the fact that its project people report directly to Air Force Secretary Seamans.

As the list of ESD projects on page 42 suggests, electronics is big business at the Hanscom Field facility, as it also is at the Air Force Rome Air Development Center, at Griffiss AFB, N. Y., now under the Director of Laboratories, Air Force Systems Command, and about to celebrate its twentieth anniversary. Rome works closely with ESD and a host of other agencies and is primarily a laboratory facility that invents and creates working models of electronic and allied systems.

As is made clear to a visitor at ESD's facilities, the largest thrust of effort is in the field of command, control, and communications, using electronics as the lifeblood of the enterprise. Viewing electronics-based command and control as the science/art that it is, ESD's General Cody points out that a major area for "breakthrough" potential in command and control is in software—what you feed into the computers and other hardware that make up the systems. There have to be better and faster and easier ways of introducing changes of information into the electronic networks, he believes. Yet, he adds, this is not so much a matter of standardization (see also p. 44) but rather a matter of making various command and control systems and their associated computers "intelligible" to each other.

Rewiring the World?

As to sensor technology, he notes that "we've already got everything from the 'Mark I eyeball' to fancy radars, and it's grubby work to make them even better." Grubby but necessary work. As to spaceborne systems, General Cody is quite sanguine, because of the fact that so much coverage is available from space. And, by way of taking maximum advantage of the potential of spaceborne concepts, he says that ESD is in frequent and close consultation with its sister AFSC division on the West Coast, SAMSO (Space and



Missile Systems Organization), which General Cody formerly commanded.

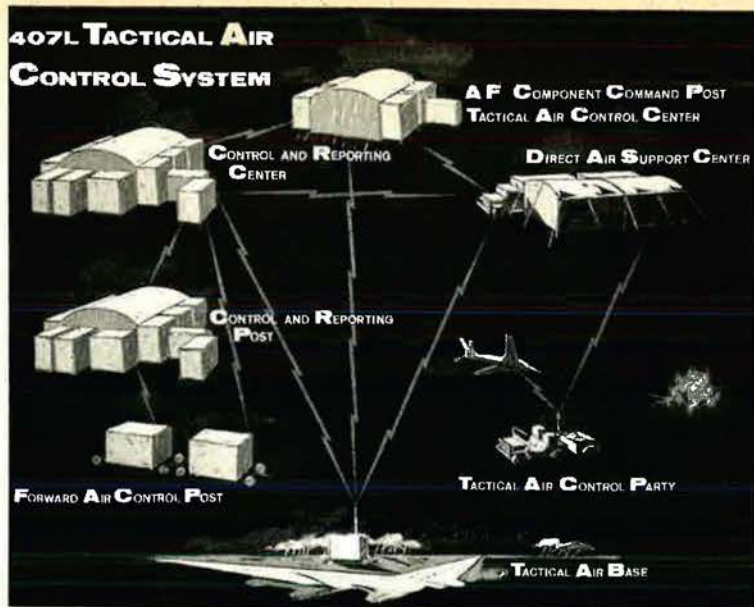
While, as he points out, it would be very difficult to build one overall global electronic system for all military command, control, and communications, let alone the expense of "rewiring the world," General Cody believes that people in the command and control business have much to learn from the more unitary space/missile systems approach. But he points out that the analogy has its limitations; that, while in space/missilery one can talk about a systems approach, in electronics it is more precise to think of the matter in terms of an "intersystems" approach.

Nowhere in military operations are the potential and problems of electronics more dramatically illustrated than in the tactical arena. While planners see the potential and the need to further automate and "electronicize," they are faced, by their own account, with the fact that there is simply not enough field understanding of the need, and that, consequently, the Air Force still lives with situations where manual and automatic techniques are often poorly blended. This tends to create situations in which too much time is taken up dealing with a volume of information that is overloaded with less than useful items in terms of utility in the process of command decision-making. ESD, with its 407L TACS (Tactical Air Control System) project, featuring easily transportable and modular ruggedized electronic gear, is trying to attack this very problem. It will provide radar capability and communications for tactical air operations, management of airspace, air traffic control, and useful linkage with ground forces.

Interestingly enough, in another facet of the tactical air environment, featuring Remotely Piloted Vehicles (see October 1970 issue, "Remotely Piloted Aircraft—Weapon Systems of the Future?" p. 40), planners emphasize that while there might be great advantage in terms of not risking pilots' lives in the air, the RPV environment would not necessarily simplify the electronic command and control requirements. They suggest, therefore, that any plan for RPV usage ought, from the outset, to be geared to very well-thought-out command and control systems to go with RPV.

Research Crucial

Pervasive today, even more pervasive tomorrow. This is the picture of electronics in the Air Force. What was true about research and development yesterday will be even truer tomorrow—that it cannot stop. Whether the problem is finding ways to detect targets in "ground clutter," or to build computers that can better sort out the "garbage" at the source (in the air or at ground radar sites or in space), or to overcome enemy electronic countermea-



In an electronic age, tactical air control must be increasingly automated. This is an ESD artist's conception of the information flow in the 407L tactical air control system project at ESD.

asures (the use of microwave acoustics—a complicated business of converting electromagnetic energy to acoustic energy and storing it until the need arises to convert it back shows some promise in the attack on that problem), the need for new technology in a constant flow is crucial. Therein lies an enormous challenge not only to "in-house" Air Force labs, but also to the US electronics industry, the most sophisticated in the world.

Beyond technology, there are questions of philosophy. One very important question is that of component reliability vs. performance demands. The Air Force is probably approaching an era in which overall costs are going to force an even greater emphasis on reliability as opposed to fancy performance. As John Jacobs, Vice President of ESD's supporting civilian contractor firm, MITRE, suggests, up to now there's been an understandable tendency to sacrifice reliability, to some degree, in favor of such factors as mobility and light weight. In the nature of things—because of the one-chance aspect of space operations—the tendency in *that* field has been the other way around. But costs, he suggests, are bringing about the increasing acceptance of the reliability priority in earthbound systems. Better a larger number of reliable but lesser performing radars, for example, because the more reliable units there are, the more *total* reliability you'll get.

Even in military electronics—as arcane a subject as it can be to the layman—what's true for today's consumer makes sense: Keep the unit price as low as possible, have as many as you need, and make sure the thing works every time. ■

What's Happening in Electronics at ESD

Following is a list of major electronics programs at the Air Force Systems Command's Electronic Systems Division, L. G. Hanscom Field, Mass., as of July 1, 1971.

SYSTEM NO.	NAME AND MISSION	STATUS	SYSTEM NO.	NAME AND MISSION	STATUS
404L	AN/TPN-19 Landing Control Central: The AN/TPN-19 is a modular, transportable, all-weather, lightweight Ground Controlled Approach (GCA)/MRAPCON facility designed to provide simultaneous surveillance, identification, terminal area control, and final approach control of aircraft at a fixed or forward tactical air base. The facility includes an Operations Shelter, an Air Surveillance Radar, and a phased array Precision Approach Radar.	Acquisition	418L	WESTPACNORTH Compatibility Program: Vehicle by which air defense systems in the Western Pacific region will exchange information. It will establish an overall operational capability of a single air defense system in Japan and surrounding waters.	Acquisition
407L	Tactical Air Control System (TACS): A highly mobile communications and electronics system for command and control of tactical aerospace operations. Capable of modular deployment by airlift, helicopter, and truck, 407L can be adapted to specific geographic requirements. The system will provide radar and communications in the tactical environment, airspace management, communications for Army support, and air traffic control.	Being procured and implemented on a priority basis depending heavily on existing technology and system engineering	425L	NORAD Combat Operations Center: A system fully integrated, survivable, and automated which collects, processes, and displays data in a manner to enable CINCNORAD to take full advantage of aerospace weapons and warning systems to carry out his mission to defend the North American continent.	Operational in underground facility. Improvements continuing
411L	Airborne Warning and Control System (AWACS): Provides a survivable airborne air surveillance capability and command, control and communication functions. Its distinguishing technical feature is the capability to detect and track aircraft operating at high and low altitudes over both land and water. It will be deployed by TAC in both initial phases of hostilities and in protracted situations. For ADC, it provides an efficient solution to the requirements for survivable strategic air defense surveillance and control.	Acquisition	427M	NORAD Cheyenne Mountain Complex Improvements: A system to acquire, with growth potential, new and improved data processing equipment, software, displays and communications for the NORAD CMC, for the purpose of providing a responsive and reliable capability through 1980.	Acquisition
414L	North American Over-the-Horizon Radar (NORAM): Provides ADC an early warning system against threat of attack on North America by aircraft. Utilizes over-the-horizon backscatter radar technique.	Definition Phase	433L	Weather Observing and Forecasting System: A system for the modernization of the Air Force Weather Service to provide high-quality and timely weather observations, information, studies, advice and forecasts in support of military operations and command and control systems.	Acquisition and Operation
416L	SEED CLEAR: Update of the existing AN/FPS-27 radar sets to satisfy operational requirements of the North American Air Defense (NORAD) System.	Acquisition	436M	SEED CUPS: Time-phased replacement of SAC computers with third-generation hardware and accompanying software.	Acquisition
416M	Back-Up Interceptor Control System (BUIC): An austere control system functionally comparable with the Semi-Automatic Ground Environment (SAGE) Air Defense System with lesser capability but greater survivability through dispersion.	Operational	440L	Forward Scatter Over-the-Horizon Radar: Provides DoD activities with the capability for real-time information on strategic threats to national security.	Acquisition/Test/Interim Operation
416M	White Sands Missile Range Surveillance System (WSMR): A semi-automatic airspace management system for the White Sands Missile Range (Army). Provides real-time detection and tracking of balloons, aircraft, and drones.	Acquisition	441A	Backscatter Over-the-Horizon Radar: A research and development system to provide the Air Force with a future capability for detection of strategic threats to national security.	Acquisition
416P	Joint CONUS Test Program/SEA Implementation: Conducted in the United States to provide compatible interfacing of several Southeast Asia (SEA) systems prior to implementation in SEA.	Implemented	441D	COBRA TALON: A system to provide the Air Force with a detection and tracking sensor system for overseas deployment.	Acquisition
418Q	Common Digitizer: A data processing system to be employed at USAF, Canadian, and USAF/FAA joint-use radar sites, replacing AN/FST-2. Provides search and beacon radar data in digital format to both the SAGE/BUIC and FAA National Airspace Systems.	Acquisition	451D	COMBAT GRANDE: Modernization and semi-automating of an existing aircraft control and warning network in Spain.	Definition Phase
			465L	Strategic Air Command Automated Control System: A system which transmits, collects, processes, and displays data to assist the Commander in Chief, Strategic Air Command (SAC), in commanding and controlling his forces.	Transitioned to AFLC; evolutionary improvements continuing
			469L	Conversion of Range Telemetry Systems (CORTS): Program to design, develop, and procure telemetry equipments to accomplish a conversion of telemetry frequency operations from P band to L and S band at three test ranges—Armament Development and Test Center, Air Force Flight Test Center, and the 6511th Test Group (Parachute) Range.	Implementation

SYSTEM NO.	NAME AND MISSION	STATUS	SYSTEM NO.	NAME AND MISSION	STATUS
474L	Ballistic Missile Early Warning System (BMEWS): Radar system to provide automatic detection and early warning of mass missile raids against North America and the United Kingdom.	Operational	634B	Unified Communications, Navigation, and Identification (UCNI): A system to unify the functions of communication, navigation, and identification for positive control of aircraft. It will permit worldwide secure identification for USAF operations in the 1980 period.	Conceptual Phase
474N	Sea Launched Ballistic Missile Detection, Warning and Display System (SLBM): Provides a capability to detect and identify mass missile raids against the Continental United States from adjacent waters, and to display warning information at SAC, NORAD, and the National Military Command Centers.	Operational, with improvements continuing	683J	Data Automation for TACC Complex: A program to demonstrate the technical feasibility and military utility of the application of automation techniques to the Tactical Air Control System.	Advanced Development
481B	Advanced Airborne Command Post: A system to provide a capability for the National Command Authority, through the JCS, to exercise continuing strategic operational direction of the unified and specified commands in a general war. Using an aircraft adapted for the command and control mission, the Advanced Airborne Command Post will provide a highly survivable, directly inter-netted system of facilities.	Conceptual Phase	687J	TACSATCOM: ESD is responsible for acquiring 45 UHF assorted ground, airborne, and shipborne terminals for use by all three services for the first phase of the program. Also responsible for operational feasibility testing of all Air Force terminals.	Acquisition/Test
482L	Emergency Mission Support: A system which will provide air transportable air traffic control, communications, and navigational aid facilities in support of emergency air operations.	Updating program under implementation on an individual equipment basis	1126	SEEK STORM: A program of high-level national interest in response to Hurricane Camille's devastation. Ultimately intended to provide the Air Weather Service tropical storm reconnaissance aircraft with an improved radar for tropical storm penetration, surveillance, and mapping.	R&D Equipment Operating for Data gathering and analysis prior to Prototype Phase
485L	Tactical Air Control System Improvements (TACSI): Provides evolutionary improvements of equipment and capabilities of communication and electronic systems for command and control of tactical aerospace operations. The system consists of automated and miniaturized equipment compatible with existing Tactical Air Control System (TACS) equipment and interfaces with automated tactical data systems of the Army, Navy, and Marine Corps providing interoperability of joint forces.	R&D and Acquisition	1627	Integrated Air Offensive/Defensive Test Environment (HAVE EDGE): The objective of this planning activity is to develop conceptual configurations and costs, and to determine the feasibility of a realistic test environment in which a credible assessment can be made of all aspects of tactical and strategic air offense and defense. In this environment, weapon systems, forces, tactics, and training will be evaluated as well as the capabilities and readiness of certain systems under development that require a complex test environment.	Conceptual Phase
487L	Survivable Low Frequency Communications System: Provides a secure emergency means to launch the retaliatory force during or after a nuclear attack. May also be used as a general command channel.	Acquisition	5222	Airborne Weather Reconnaissance System (AWRS): A high-priority program to provide the WC-130 and WC-135 fleets of the Air Weather Service (AWS) with improved meteorological data-gathering and information-processing equipment designed to respond to the weather forecasting requirements of the 1970s.	Acquisition
490L	Overseas AUTOVON Switches: The key element of the overseas portion of the Defense Communications Agency's program to implement a worldwide Automatic Voice Network (AUTOVON). This system provides an automatically switched, wide band communications network for the Defense Communications System.	Operational, with improvements continuing	6917	Command, Control and Management Data Systems Software: Provides for the evolutionary development of computer software in three areas: WWMCCS Operational Support, USAF Operational Support, and AFADS Technical Program. Technical Program includes System Software Standards, Software Evaluation, Software Measurement Techniques, Processing Languages, and Computer Aided Instruction/Exercising Techniques.	Continuing
492L	USSTRICOM Command and Control System: A semi-automated support to CINCPAC, the USSTRICOM Joint Staff, and the USSTRICOM Joint Task Force Command elements in their efforts to ensure the availability and effective employment of USSTRICOM forces in performance of assigned missions. The system consists of elements that facilitate the performance of command functions at fixed Headquarters and at the Main Headquarters en route to and deployed in the objective area.	Under Implementation	7820	Communications Security (COMSEC): A program to guard overall security of systems against interception, traffic-flow analysis, cryptographic failure, and electronic countermeasures.	Continuing
493L	Interim AUTOSEVOCOM: An automatically switched secure voice communications system consisting of three prototype switches.	Operational, with improvements continuing	(no specific project number)	IGLOO WHITE: An air-supported, anti-vehicular and anti-personnel system for SEA.	Operational, with improvements continuing
496L	SPACETRACK: The Air Force worldwide system for electronic detection, tracking, identification, and reporting of all objects in space.	Operational, with update of Space-track radar	(no specific project number)	Integrated Circuit and Message Switch: A lightweight, transportable communications system, modularly expandable from 600 to 2,400 lines, that integrates circuit switching and message switching in one communications center. Primarily aimed at satisfying a wide range of mission requirements with either all analog traffic, all digital traffic, or a mix of both.	Conceptual Phase
499L	AIMS Program: The modernization of radar beacons for military use, to improve air traffic control for FAA and provide secure identification for USAF ground command and control centers.	Acquisition	(no specific project number)	TRI-TAC A triservice development program for tactical ground point-to-point communications in a combat theater for the 1980 period. The program is directed primarily toward trunking and switching equipments and interface equipments between or among all services. The Electronic Systems Division role is to provide Air Force ground-to-ground communications requirements to TRI-TAC and develop and test selected equipment which will be used by the various services.	Definition Phase

THE ELECTRONIC AIR FORCE

Air Force requirements for more capable, faster command and control coincide fortuitously with a new round of significant advances in computer technology. But as the complexities of large, time-shared machines increase, so does the difficulty of cost-effective utilization. As a result, the Air Force is changing its attitudes and policies toward computers in recognition of the fact that computers are . . .

The Military Decision-Makers' Top Tool

By Edgar Ulsamer

SENIOR EDITOR, AIR FORCE MAGAZINE

IN TODAY'S Air Force the computer is ubiquitous and indispensable. More than 1,200 ground-based computer systems, comprised of more than 2,000 individual computers, are being operated by the Air Force at an annual cost of almost half a billion dollars. Many thousands more operate aboard the Air Force's aircraft, missiles, and satellites. The tasks these machines perform range from analyses of Soviet missile launches to aiming guns, from writing paychecks to nuclear-war simulation.

Two factors drive the Air Force, and the other military services, toward ever greater reliance on these versatile electronic devices, which, now in their fourth generation, mimic the human mind to a degree deserving of the sobriquet "artificial intelligence." One is the cost-effectiveness of computers in an era of rapidly escalating manpower costs; the other is the paramountcy of speed in all actions and reactions of modern, especially nuclear, warfare, which culminates in the need for "real-time" decision-making by the command and control authority.

As the lethality and speed of modern weapons increase, so does the requirement for rapid response. Speed and the ability to perform vast numbers of calculations with high accuracy are inherent characteristics of the computer. That capability is being aided enormously by present trends toward both miniaturization and parallel and associative data processing. The latter feature is beginning to supplant the more cumbersome "serial" computer technology by one designed to deal with data in a selective, cognitive fashion rather than processing all information fed into it one step at a time, without regard to what's relevant and what isn't.

Major USAF Computer Usage

Air Force computer experts generally break

down USAF computer applications into eleven major areas:

- Command and control of operating forces.
- Resource and inventory management.
- Intelligence data handling.
- Communication routing and switching.
- Base and command management support.
- Information services.
- General data processing.
- Weapon system research, development, test, and evaluation (RDT&E).
- Scientific and engineering activities.
- Weapon system guidance and control.
- Studies, war games, modeling, and simulation activities.

The diversity of these key applications has created, unwittingly and unavoidably, the principal dilemma that the Air Force faces with regard to computers: proliferation of both hardware (the actual machines) and software (data format and programming). Yet this diversity in computer architecture and language collides with a basic and vital requirement that takes on preeminence as the Air Force moves toward more sophisticated management of its computer resources: the coupling of these various systems.

The problem, in an oversimplified way, is analogous to a number of telephone users trying to communicate, who not only use different and technically incompatible telephone sets, but also all speak different languages.

The Software Problem

It is Department of Defense policy to buy all so-called general-purpose computers off the shelf, meaning that the systems were developed by the manufacturers without optimization for any specific civilian or military application. Computers of this type are furnished, in the terminology of the industry, with basic "non-

functional" software by the manufacturer. This consists of the fundamental language capability and other basic organization of a computer's memory section. The actual tailoring of the system to a specific mission—the creation of "functional" software—has to be systems engineered on an individual basis and may involve the efforts of as many as 100 experts over a period of months.

Underlying the software problem, in the view of Brig. Gen. Lee M. Paschall, Hq. USAF's Deputy Director of Command Control and Communications and head of the Air Force's Select Committee on Computer Technology, is "a fourfold, fundamental system's question: What information is needed? Who should receive the information? What is the user going to do with the information? And, what is the source of the information?"

The answers often bog down in the difficulty of communicating between the systems designers, the users, and the programmers who implement the system. Popular notions notwithstanding, computers can only do what they are programmed to do. If programmed correctly, they will be right with nearly the speed of light; conversely, any error in programming logic will cause them to be wrong, also with the speed of light.

To exacerbate the problem, a computer's logic is very unforgiving and cannot function with such ambiguities as are found in human language. The translation of information requirements (originated in the relatively loose style of human speech, first into logic diagrams, then into flow charts, and subsequently into the code of the computer) is both complex and costly.

In the absence of any standards for software design—generally considered "an art rather than a science"—the tendency in the past has been to create software on an *ad hoc* basis. Initially, this was neither surprising nor alarming because the first generation of computers (which used bulky vacuum tubes) usually could perform only one-of-a-kind, specialized tasks. The fact that computers were not mutually compatible was of little significance.

In addition, the high cost of a computer's memory, the section where its "knowledge" is stored, was far greater than the programming expense.

But, first the transistorized (second generation), then the integrated circuit (third generation), and as of late the large-scale integrated circuit (fourth generation) computers came into being. Through this series, the cost of memory, and thereby the cost of performing a certain function, has declined. The cost per bit (bits are the smallest unit of digital intelligence and make up the machine's memory) has decreased from about ten cents to about one-tenth of a cent as a result.

New memory techniques currently under test

point the way to further reductions. In addition, these hardware developments not only tilted the cost ratios toward the software design portion, but, because of the greater complexity and capability of modern computers, necessitated a corresponding growth in the sophistication of software. The irony of the present situation, according to Brig. Gen. K. R. Chapman, the Air Force Systems Command's Deputy Chief of Staff for Development Plans, is that often "because of the pervasive importance of software, and because it literally takes years to debug [find and correct programming errors], you discover that by the time the data management system is finally perfected, the application needs to be modified and you start all over again."

Programming errors can occur easily because many programmers write individual yet interdependent elements of a given computer program simultaneously, and because they do so in a largely free and creative, rather than a formalized, fashion. Programming errors have become more significant as the operating speed and complexity of modern computers have increased. Merely locating such an error—which might have been made in less than a minute—within the vast memory of a third- or fourth-generation computer can take weeks.

The Air Force's Select Committee on Computer Technology, in analyzing the mushrooming software requirements, concluded that programming costs will soon reach a level three to seven times greater than hardware costs.

The Computer's Tower of Babel

While uniform programming and coding techniques, called computer languages, help in the coupling of individual installations, they also entail certain drawbacks, especially so far as older hardware is concerned. In order to provide computers that perform different jobs with a common language, it is necessary to allocate a portion of their memory to store these generalized instructions. The broader the language, the more space is used, and the less there is available to program the computer for the specific tasks it is to perform.

At this time, the Air Force uses three different families of languages for its key areas of computer applications: FORTRAN for scientific applications, COBAL for business applications, and JOVIAL for command and control applications. Each of these sets of languages, however, is subdivided, with the result that the computer languages in operation in the Air Force number almost one hundred. Except for some costly new techniques currently under test by DoD's Advanced Research Projects Agency (ARPA) [see January 1971 issue, "The Age of Talking Computers," p. 49], these cannot be coupled to share each other's information and processing capabilities. One major



Brig. Gen. L. M. Paschall is USAF's next Director of Command Control and Communications.



Brig. Gen. Kenneth R. Chapman is AFSC's DCS/Development Plans.

Air Force command, it was found recently, operates thirty-five computer installations involving twenty-five different types of machines "speaking" seven different languages.

In the view of many experts, this proliferation, especially in terms of computer software, has had a distinctly deleterious effect on the outlook toward computers of senior Air Force leaders and managers. The fact that software represents a far greater problem and cost factor than hardware is not easily understandable. As a result, software R&D programs in the past have received inadequate attention and funding compared to investments in hardware.

Also, because of the arcane mathematical problems of computer experts, the jargon that inevitably resulted, and the natural human tendency to enshrine the complexities of programming in a special mystique, a "witches and warlocks syndrome" developed. This inhibited both understanding and use of computers. But both tendencies are beginning to disappear, and "the Air Force's managers are accepting computers more and more as these machines are moving out of the back room and go on line, with the commanders, as invaluable decision-making tools," General Paschall said.

A Centralized Computer Authority?

A number of steps that are currently under review could help "create order out of the hardware and software chaos." Common to all is the establishment of an Air Force-wide computer authority, answerable directly to the Air Staff. Creation of such an organization is currently under consideration by the Air Staff and is likely to take place later this year. While its exact nature and scope have not been fully determined as this is being written, it almost certainly will include the mandate to set software standards, to serve as a clearinghouse for information on computer technology, to make long-term determinations with regard to hardware and software development programs, and to act as a consultant to all Air Force users of computers. Eventually, it might well become USAF's link with a national regulatory or advisory authority on computer standards. Formation of such a government-wide computer agency, either as part of the Federal Communications Commission or through the creation of an entirely new federal body, is generally considered necessary. USAF's computer authority would draw together the "pockets of knowledge" that are at present scattered throughout the Air Force and believed to consist of about 24,000 personnel trained in computer technology and operations.

Efforts to standardize and streamline software, which in its broad application is also called data management system, are already under way in the Air Force. Preceded by a comprehensive inventory-taking of all existing soft-

ware, measurement of the characteristics of each, and determination of what tasks individual techniques can and cannot do, this program seeks to create software designs of broader utility. Air Force experts connected with this effort point out, however, that the formulation of "Logically Flawless Programming Methods" will require substantial funding and that, to date, adequate allocations have not been made.

A more ambitious technique to simplify the software problem is currently under test and uses the computer to help write its own programs in areas of routine operations. This approach, which lets the computer draw from previously written subroutines and requires that only specialized functions be programmed individually, shows potential for reducing software costs to about one-fifth the present level.

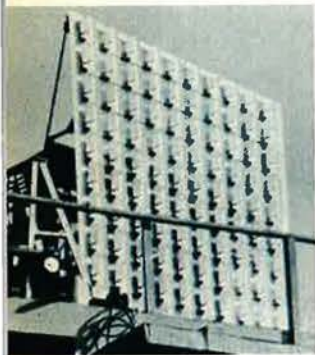
Whenever practical, the most effective and certain means for overcoming the software problem is standardization of the hardware, such as in the current update program of the Worldwide Military Command and Control System (WWMCCS), for which the Air Force acts as procurement agent. This program, currently in source selection and which eventually may involve as many as 100 computer systems, in General Paschall's view, represents a "realistic step forward in standardization by relying on common hardware and some common basic software." A small portion of each WWMCCS computer system is reserved to move information to and from other points on the net while the major capacity of each machine is available to perform, in optimum fashion, tasks peculiar to individual users, such as SAC or NORAD command and control functions.

But hardware standardization generally presupposes a requirement to update obsolescent installations, a condition that prevails with regard to WWMCCS and such key components as SAC, NORAD, and the Ballistic Missile Defense system. All these installations, General Paschall said, required "a computer update because they could no longer cope with the increasing work load and for reasons of cost and maintenance effectiveness," thereby creating the opportunity to construct an interconnected system.

Microprogramming and Metacompilers

A new technology called microprogramming is beginning to enter the inventory, according to General Chapman, and will provide computers "with a basic, common platform of knowledge which, in a sense, means at that level they can talk to each other." This hardware technique, whose feasibility has been demonstrated and which is likely to be incorporated into all new computer designs in the near future, means "hardwiring software right into the machine."

It entails designing a computer's basic logic



circuits with sufficient flexibility so that the system can actually be directed "to be the kind of machine the user wants it to be and permits him to change basic computer characteristics from run to run." This is achieved by changing computer architecture at the very core of the machine—the so-called gates. As a result, different "word lengths" and different logic paths (which account for the differences and incompatibilities of present generation computers) can be accepted by a microprogrammable computer.

Air Force computer experts consider this technology a "radical new departure because it topples the old doctrine of making the software compatible with the hardware. Instead, microprogramming adapts the hardware to the software."

An extension of this design philosophy—multiprogramming and multiprocessing—would make it possible for a computer system to interchange key components to be compatible with other computer systems and their software even more rapidly.

In addition, some Air Force scientists believe that, as the cost of elementary computer components continues to decline, modular design techniques will gain greater prominence. Advances in fundamental technology areas currently "on the horizon" involve mainly such new materials as MOS (metal oxide silicon) and MNOS (metal nitride oxide silicon) memories and Bell Laboratories' magnetic bubble. These materials are expected to revolutionize computer technology as much as did the changeover from vacuum tubes to transistors. By being able to "tailor the modules to a specific application, it should become possible for the designers to optimize the entire system to the needs of the user, without having to resort to costly software adaptations."

Modular design techniques are also considered vital for sophisticated military space applications. AFSC's Space and Missile Systems Organization (SAMSO) is currently designing a "Modular Spacecraft Computer System" that is to have a life span of between five and eight years and will include the ability to diagnose its own, as well as the spacecraft's, malfunctions and to repair itself by shifting tasks among its modules.

Another technique showing promise with regard to alleviating the software problem is currently under review by Air Force computer experts, but is sensitive since it affects tasks traditionally performed by industry. Called metacompiler, this highly complex technique makes it possible for the computer to "produce its own compiler to write its own language" from a description put into the machine manually. This would permit the Air Force to set up a "compiler library" for all its computers. Private industry might be significantly affected by this move, since it currently supplies the

compilers. While policy with regard to meta-compilers has not been set, there is little doubt that, in a general sense, the Air Force will perform more tasks in-house, "without necessarily seeking to preempt industry." The motivation, in addition to cost, is to develop and retain more computer talent in the Air Force and, as one computer scientist put it, "You can't keep these kinds of creative people unless you give them a hands-on [actual operational] involvement. In addition, a greater in-house capability automatically improves our effectiveness in monitoring industrial contractors."

The Advantages of Miniaturization

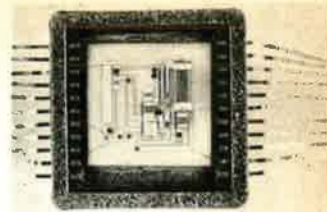
In modern computers, size equates with speed and the basic accuracy of the machine's operations. Third-generation computers perform functions in the nanosecond (10^{-9} seconds) range, a period during which an electric current travels a distance of only one foot. Circuitry that is not dimensionally compact obviously would deter high-speed computer technology. Integrated-circuit technology has made it possible to process information at the rate of 10^4 bits per second. "But in the near-term future, we believe, we are going to step up to between 10^6 and 10^8 operations per second, which will be vital in terms of accuracy as well as compatibility with the high data rates of advanced sensors," General Chapman said.

Computer speed is of crucial importance to command and control applications, especially in the strategic arena. Surveillance and warning systems, such as the highly sophisticated 647 system, believed to provide specific information about Soviet ICBM launches within about a minute, produce data at a furious rate. For example, laser and other wide-band communication links are capable of transmitting data at a rate of 10^6 bits per second. Command and control computers must accept this high flow of information from several sensors and compare the information against "behavior patterns" stored in the computer, in order to make such determinations as to whether an object that is being tracked by radar is a decoy or a warhead.

Obviously, the processing speed of the computer must at least equal the data rate of the sensors. If this capability does not exist, it becomes necessary to "round off" the digital data from the sensors, meaning the computations are not carried out with complete accuracy. AFSC, in concert with RAND, is currently conducting a study of how future data-processing functions could be affected by new sensors with even higher data rates.

Parallel and Associative Processing

Most computer experts believe that, despite dramatic advances in memory design and pro-



cessing speed, serially programmed computers will not be able to function cost-effectively in very demanding command and control applications. Even integrated circuits that jam as many as 10,000 transistors into each square inch to minimize the "distance problem" inside computers eventually hit the barrier set by the speed of light. A giant step toward overcoming this hurdle was taken by the ARPA-sponsored supercomputer, the University of Illinois' ILLIAC IV [see "The Coming Age of Talking Computers," January 1971 issue, p. 49]. It is actually sixty-four "slave" computers wrapped into one for parallel processing operations. It can perform as many as 200 million operations per second and speed up some tasks 200 fold, compared to conventional systems.

But a more advanced design variation known as "associative processing" is currently under development and test to provide the capability for "pattern recognition and analysis on a real-time basis." The following analogy indicates how this technique differs from sequential (conventional) data processing: The latter functions somewhat like a man who wants to find out how many people are bachelors in a crowded theater by walking through all the rows, asking each person individually and keeping a tally; associative processing, by contrast, would have the same man get up on the stage with a microphone and ask that each bachelor stand up and be counted from the stage.

Stated another way, an associative processor can, as General Paschall put it, "vote. The machine accepts inputs from two or three data channels, performs its calculations, then, if there is no unanimity, takes a vote among the channels and ultimately selects a course of action that represents the majority view."

Two significant benefits are realizable through this technique: The opportunity to use instructions less structured than present programming, which must specify all alternatives and routes to a problem's solution. This is crucial in command and control systems because if a situation arises that had not been anticipated by the programmers, under present conditions the system will not be able to cope. Secondly, associative processing is believed to point the way toward much more selective computer information outputs by filtering out unimportant data.

At present, the military decision-maker, in General Paschall's view, "is often smothered" with information, much of it tangential to the user's needs. In addition, associative processing techniques lend themselves to simulation and thereby aid the decision-maker by showing what the effects and pros and cons of a given action might be.

The overriding importance of associative data processing to the military mission is, of course, the inherent ability to correlate informa-

tion rapidly. Systems planners view machines of this type as invaluable to future command and control applications. Effective discrimination with regard to incoming warheads and decoys, real-time reconnaissance, beam steering of phase-arrayed radar, satellite warning systems, and second-generation AWACS, among others, are considered likely candidates for associative processing at this time.

Mini- Vs Maxicomputers

Because of the miniaturization that has taken place already, and the vast increase in capability offered by associative processing, the classic distinction between ground-based and airborne computer systems is slowly disappearing. Accentuating this trend is the fact that the costs of computer memories are rapidly declining, thereby making small, independent operations economically viable. As a result, computer systems planners of the Air Force and other services face an agonizing choice "that is getting more complex by leaps and bounds. The military man's bias is toward the survivable system, a condition that would obtain if many dispersed minicomputers are used.

"The resource savings of large time-shared installations serving many users, on the other hand, are attractive from the point of economics and personnel, but vulnerable. The possibility of losing such a centralized capability in a catastrophic way makes military planners very nervous. It is likely, therefore, that eventually we will arrive at a mix between dedicated small machines and large time-shared installations," according to General Paschall.

Some Air Force computer experts believe that the requirement for interaction between various systems can be met without unduly degrading survivability by providing such computer networks with adequate redundancy. So far as the vulnerability of airborne and missileborne systems is concerned, shielding and other protective measures are already at such levels that "computer hardening often exceeds the hardening of the system on which the machine is deployed."

In the case of satellites, for instance, shielding components and devices that sense the occurrence of the EMP (electromagnetic pulse) from a nuclear blast, and cause the computer to shut down before its memory is destroyed, make it possible to harden the computer at least to the same level as the vehicle itself.

Two Key Study Efforts

Two major study efforts, designed to establish how the Air Force should direct and exploit computer technology, are currently under way. One is called the Command and Control Information Processing 1985 study, described by General Paschall as a "road map for the next



fifteen years, which is trying to establish what kind of information-processing capabilities will be needed in command and control, what are the available technologies, and where are the technologies deficient."

The other study group deals with tactical command, control, and communication requirements and is being conducted by AFSC's Electronics Systems Division at Hanscom Field, Mass. Both are conducted on an in-house basis, under the guidance of a steering group of general officers.

The two studies, which are to be completed some time this fall, are an outgrowth of the Air Force's Select Committee on Computer Technology, which interviewed some 300 experts from industry, other government agencies, and the military to provide overall direction to the Air Force's policy regarding computer technology.

While these studies are not complete at this time, preliminary findings indicate that computer utilization for tactical missions is still in an embryonic state. Many of the functions already performed by computers in strategic command and control applications can be translated almost directly to the tactical arena, in the view of General Chapman. "We simply have not stepped up to the problem to the degree we should. Technically, we know we can write the software programs necessary to tie recce, intelligence, weather, crew, and aircraft status information together and have the computer actively write the frag order [fragmentary instructions to individual wings pertaining to the particular missions to be flown that day]," he said.

The Seek Data II program, now operational in Southeast Asia, is already performing many of these functions. Real-time computerized tactical command and control systems, however, will have to be able to work in concert with the Army's automation efforts in the same arena. General Paschall suggested that an advanced automated tactical system, which applies and extends Seek Data II, might "couple all target inputs so that they actually drive the system and provide automatic target generation on a viewing screen," which can be "edited" by the commander and gives him almost real-time control over his forces. General Chapman stressed in this connection that displays take on ever greater significance because "they are the interacting part between the commander, the system, and the entire operation." Flat panel "plasma displays," which facilitate "holding" a given situation and changing specific factors, are currently rated as promising for tactical command and control applications.

Some planners believe that tactical command and control could also be exercised through a computer installation aboard a large aircraft or, as one expert put it, "via satellite and wide-

band data links right from Washington, D. C. The technology exists that lets you operate the system just as efficiently from the Pentagon as from Saigon."

The Outlook

In a more general sense, Air Force forecasts regarding future computer technology and application trends uniformly predict mergers of the various systems currently deployed independently without ability to interact. Management-support-type systems are already merging with command and control systems, and the trend toward machines drawing on remotely located data banks can be expected to accelerate rapidly in the years ahead, according to General Paschall.

Freer forms of programming, although most likely not voice-instructed computers, are expected to enter the inventory by the end of the decade and provide a boost to computer utilization since they might permit commanders and staff people to communicate with the machine without having to go through programmers.

Key areas of concern involve privacy of information and priorities of data processing in time-shared or netted systems because "computers will, of course, store information that today is kept in safes and because an interacting system, serving both management support and command and control applications, obviously must be geared to give precedence to high-priority command and control data," General Paschall said.

Possibly the most difficult question that computer systems planners are currently wrestling with is "where will man fit into the decision-making loop in the future."

As General Chapman put it, "It is absurd to think of man not being in the loop; the only question is how do we use him best. Technically, we have great flexibility in accommodating the requirements of the commanders. The efficiency of automated operations is basically only constrained by the efficiency with which we program and prejudge the relevant factors. The big question is what decision points does the commander want to draw off the displays and how should we narrow the focus of all the information available to him, to give him the best decision-making tool?"

General Paschall concluded with the prediction that "eventually—because of ever-increasing data-processing speed—we might reach a point where man's judgment and decisions will be no more than a veto. But it will always be a conscious decision to either veto or not to veto." Clearly, artificial intelligence, with all its capability as man's foremost decision-making tool, is not about to replace him. ■

EIA—Serving the Electronics Industry

By V. J. Adduci

PRESIDENT, ELECTRONIC INDUSTRIES ASSOCIATION

ELECTRONICS is big business, and getting bigger, both here and abroad. In the United States alone, \$25 billion in electronic goods and services are produced each year, providing jobs for nearly one million Americans.

Throughout the free world, the present output of electronics products is \$43 billion annually. This figure may well go as high as \$110 billion by 1980, and if it does, the US industry's dollar volume share could be as much as \$44 billion.

The big question is the defense market, now leveling off with the wind-down of the war in Southeast Asia. There are indications, however, that new and complex weapon systems, based on advances in technology, will be needed to replace present systems. Such trends could increase defense purchases of electronic equipments and components and halt further decline in defense procurements. Smoothing the industry-government interface in this critical area is one of our main jobs at Electronic Industries Association.

To help industry plan programs to meet the future needs of the Defense Department and other government agencies, long-range forecasts are regularly prepared by EIA's Government Products Division's Requirements Committee. Recent studies have dealt with such subjects as "The Post Vietnam Defense and Space Market," "Major Issues Affecting the Defense Industry," and "Impact of Changes in Government Procurement Practices." In more tightly focused action, last year the EIA Government Products Division's Defense Communications Council Committee on Automatic Imagery Pattern Recognition organized a Symposium on Automatic Photo Interpretation. The symposium brought together scientists involved in current technical developments in photo interpretation with the people who can guide the application of these developments to solve pressing needs. Four sessions were held on current developments in industry, the universities, and government.

In January of this year, sponsored jointly by EIA and DoD, a meeting on "Tactical Reconnaissance and Surveillance" was held under the joint sponsorship of DoD and the Association. The aim was to give senior representatives from industry and DoD an opportunity to exchange views on operational needs, advanced systems concepts, and developmental programs required in the tactical reconnaissance and surveillance fields. The three-day symposium covered future conflict environments and requirements for servicing reconnaissance and surveillance equipment, systems, and subsystems applicable to these requirements, resource allocation between planned and strike reconnaissance, data management, and battlefield surveillance.

EIA's interface activities also extend into the area of standards making, where we long ago established a solid reputation. Earlier this year EIA participated in the DoD "Uniformity Program," which seeks to standardize the common elements of the twelve DoD general electronic equipment specifications and publish these common requirements in a single military standard (MIL-STD-454).

In the communications area, EIA has been active in standards making through the Communications Standards Committee of its Defense Communications Council. The committee was asked by the Defense Communications Agency last year to coordinate industry comments on twenty-five to thirty proposed new standards on all types of communications equipment, entitled "System Design Standards Applicable to the Defense Communications System." Among the subsystems covered were time division multiplex, pulse code modulation, modems, and high-speed digital links.

An outstanding accord between government and industry has been achieved through EIA-sponsored workshops on configuration management. The workshops—nine have been held to date—have led to a greater understanding by both parties of the objectives of configuration management, that is, to ensure that all items of equipment in a given series will be the same; that the delivered items of equipment are accurately and completely described by all identifying documentation; and that there exists a configuration record documenting approved changes.

EIA recently established a Policy Committee on Computer Systems Netting and Interoperability, to further the development of standards for interoperability; serve as a clearinghouse for information and as a liaison group between government and industry; and promote development of new computer netting techniques.

The new group is an outgrowth of an industry plan presented to the Pentagon and Defense Communications Agency officials on the netting of civilian and DoD computer systems. This plan proposed development of an inventory of existing hardware and software systems and their characteristics, capabilities, and interoperability; development of techniques of netting discipline; review of existing standards and, where appropriate, development of new ones; use of the systems approach and cost-effectiveness analyses when designing future systems; establishment of interdisciplinary communication and training and a common vocabulary among the technical disciplines involved in interoperable systems; and establishment of training curricula for the broader background required by operators of netted systems.

One thing is clear, as other articles in this issue of AIR FORCE Magazine point out so cogently. The military services, and notably the Air Force, are going to depend more and more on electronics for both management and operational requirements. I know I speak for the electronics industry of the United States when I say we stand ready to do our part in satisfying the needs of national defense. ■

V. J. "Jim" Adduci has been President of EIA since last October. Before joining EIA, he spent ten years with the Aerospace Industries Association, and earlier he had a distinguished military career in the US Air Force, serving in Africa, England, Germany, France, Korea, and Japan.

Neither the strategic threat to the US and its allies nor the sufficiency of US strategic forces can be measured by a simple comparison of US/USSR missile and bomber inventories. A meaningful assessment must include analysis of the offensive and defensive forces of both sides; military policy; scientific and engineering capabilities; budgetary support; the multiple uses for which some Soviet systems are adapted; and the growing Chinese strategic arsenal. Allegations of US strategic overkill then lose their credibility, as shown by a top USAF intelligence officer in this detailed examination of . . .

The Strategic Threat

By Brig. Gen. Harry N. Cordes, USAF

DEPUTY CHIEF OF STAFF, INTELLIGENCE,
HQ. STRATEGIC AIR COMMAND

AN INESCAPABLE fact of the 1970s is the Soviet Union's inventory of powerful and modern strategic weapons approaching—and in some cases, surpassing—ours in quantity and in quality. The importance of this change in relative power of the US and USSR should be of real concern to all Americans, and countless official and unofficial statements have addressed the relative strengths of the two superpowers.

Before analyzing this threat, one fact of traditional Soviet military policy must be considered: a reliance on mass—the concentration of arms at the critical place and time to the maximum extent possible. This is evident in their large land forces, their emphasis on firepower, and their propensity to retain older, proved systems. At the same time, they deploy barely operational new systems with the view of incorporating qualitative improvements in later modifications. These Soviet policies are apparent today in both strategic offensive and defensive forces.

The Soviet ICBM Force

The expanding Soviet strategic threat is reflected in the rapid growth of their ICBM inventory. Since initial deployment in the early 1960s, the Soviets have developed a number of ICBM systems, although growth of the force was quite moderate until 1965. Since then, an

accelerated research, development, testing, production, and deployment program has resulted in a force today approaching 1,500 launchers—considerably larger than the 1,054 US ICBMs and almost seven times larger than the Soviets' 1965 inventory. Furthermore, deployment continues.

Currently, three ICBM systems—the SS-9, SS-11, and SS-13—are being deployed, though at reduced rates, and two of the earlier versions still are retained. These early systems, the liquid-fueled SS-7 and SS-8, were deployed in only limited numbers; however, their retention in the Soviet inventory illustrates the point made earlier about the propensity to retain older, proved systems.

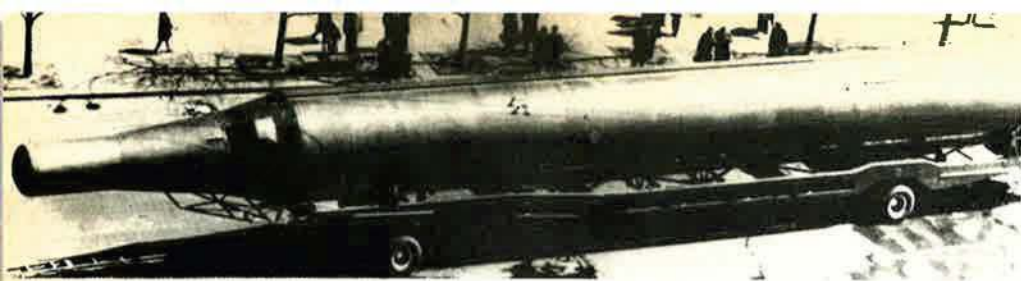
At this time, the largest segment of the ICBM force consists of SS-11s. Deployment of these launchers

appears to have leveled off at the present time at somewhat in excess of 900. In addition, the Soviets have tested SS-11s with a new reentry vehicle that has shown improved performance. Last August, Secretary of Defense Melvin R. Laird announced that two extended-range tests of the SS-11, into a Pacific Ocean impact area, may have carried as many as three reentry vehicles. Thus, multiple reentry vehicles are a distinct probability for this system.

Little is known about the only solid-fueled ICBM system in the Soviet inventory—the SS-13—except that deployment has been limited. Its testing continues, and deployment could be resumed at any time. It could also provide the technology for a mobile, land-based ICBM in a few years or for a completely new system.



SS-13



SS-9

Their most awesome and destructive weapon today is the SS-9. Liquid fueled, it is deployed in nearly 300 silos operational or under construction. The SS-9 has been tested in a variety of strategic roles. Its payload options include up to a single twenty-five-megaton warhead or combinations of smaller multiple warheads. The multiple reentry vehicle version as already tested can carry three reentry vehicles, each capable of delivering a five-megaton weapon to a range of more than 5,000 miles. The SS-9 also has served as the booster for tests of a fractional orbital bombardment system (FOBS). The large-payload SS-9 missile appears to have great versatility, with its flexibility offering the potential for a wide variety of employment or deployment options.

As mentioned previously, there has been an apparent slowdown in deployment of the three current systems—the SS-9, SS-11, and SS-13. One possible reason for this was revealed recently by Secretary Laird. The Soviets may be deploying a new ICBM with concurrent construction of new silos. While the missile associated with these new silos has not been identified as yet, it could be an improved version of already proved, flexible systems.

Based on the level of missile activity in recent years, the Soviet ICBM force could exceed 2,000 ICBMs by the mid-1970s. The total number of ICBMs is significant, but even more important are the qualitative improvements, total payload capacity, their emphasis on multiple reentry vehicle testing, and the wide variety of options thus provided by these systems.

Supplementing the ICBM force are many shorter range, medium- and intermediate-range ballistic missiles. Although not a direct threat to the United States, since the 650-plus launchers are deployed mainly along the western USSR border,

they do present a threat to our overseas forces and bases as well as to our allies.

Sub-Launched Missiles

The third category of ballistic missiles involves the submarine-launched force. Its growth has paralleled that of the land-launched systems. In less than five years, the threat has tripled, mainly due to the production of the new Yankee class submarine.

Currently, four ballistic-missile-carrying submarine types are in the inventory. Three are older classes, but the fourth, the Yankee class nuclear-powered sub, is by far the most significant factor in the expanding SLBM threat. Like the United States Polaris/Poseidon subs, each Yankee carries sixteen missiles. At least seventeen of these subs are considered operational, while about fifteen more are being outfitted or are under construction.

Today, the United States still holds a lead in numbers of SLBMs, but the Soviets are continuing to close the gap. Present production rates for the Yankee submarines—about six to eight per year—could bring them to equality with the US in the next couple of years. By the mid-1970s, they could have about fifty Yankee submarines carrying 800 missiles.

The missile carried by the Yankee subs has a range of about 1,300 miles. However, testing is under way on a new, longer range, submarine-launched missile with the potential of doubling the present missile range and thus increasing the flexibility of their ballistic-missile submarine force.

Soviet Bombers

Rounding out the Soviet offensive power is their bomber force, which has remained relatively static at a

little over 900 aircraft since 1965. Although the United States stopped production of heavy bombers in 1962, the Soviet Union only recently discontinued a modest production. Currently, their heavy bomber force numbers 195 Bears and Bisons, about fifty of which are normally used as air refueling tankers. The Long-Range Aviation bomber force consists of about 700 Badgers and Blinders. While their range is less than the Bears and Bisons, when deployed at northern USSR staging bases, they could cover most of the United States on one-way missions. Therefore, in assessing the total threat to this country, the Badgers and Blinders must be considered, as well as the Bears and Bisons. In addition to these bombers, the Soviet Navy has more than 500 Bear, Badger, and Blinder aircraft, configured in both reconnaissance and bomber versions.

In accord with their tradition, these older systems are regularly updated with modifications. At the same time, the Soviets continue to develop new and improved aircraft. The Soviet supersonic transport (SST) has been flying for more than two years, and although there is no known direct military application, it nevertheless would provide valuable engineering data for a follow-on strategic bomber.

In addition, there are indications that a new prototype strategic bomber is now flying in the Soviet Union. Available information points to a variable-sweep-wing, supersonic aircraft with range improvements

Brig. Gen. Harry N. Cordes has been DCS/Intelligence at Hq. SAC since April 1970. A dual-rated pilot/navigator, he was at the 1946 Bikini atomic bomb tests, and has served in SAC bomb and reconnaissance units, as a SAC intelligence staff officer, and as a member of the joint Strategic Targets Planning Staff. Prior to his present assignment, General Cordes was Deputy Director of Plans for Force Development, Hq. USAF. He is a graduate of the Air Command and Staff College, the Industrial College of the Armed Forces, and holds a master's degree from George Washington University, Washington, D. C.

over the Badger and Blinder. Further indications are that it might be air-refuelable and could possibly carry a long-range air-to-surface missile, thus giving it an intercontinental capability. Since this prototype possibly is already flying, its deployment could, if it became operational, precede that of the USAF B-1 by several years.

Despite predictions to the contrary, the Soviets have made only minor reductions in their strategic bomber force during the past six years. We see a continued reliance on a mixed strategic force concept similar to our own Triad. In view of reductions in United States air defenses over the past several years, the relative threat becomes even more apparent.

Soviet Air Defenses

In order to gain a full appreciation of Soviet strategic strength, one must look at their defensive forces, as well as their offensive forces. By almost any yardstick, overall Soviet aerospace defenses are the strongest in the world. In all defensive categories, from antiaircraft artillery to antiballistic missiles, their forces are quantitatively superior. For example, with a land area not quite three times that of the US, they have from five to twenty times as many radars, surface-to-air missiles (SAMs), and interceptors. Furthermore, programs to improve air and missile defenses continue, and they have made significant progress in antisubmarine warfare.

Air defense radars number in the thousands and provide extensive warning and interceptor control throughout the Soviet Union. One feature—overlapping redundancy—characterizes the mass of warning and control radars. These radars span the full usable frequency spectrum and incorporate all the latest advancements to counter electronic jamming. In addition, the Soviet Union has under way an extensive program to improve their ability to detect and track low-flying bombers.

A key new development in air defense that may be deployed later in this decade is an airborne warning and control system (AWACS) aircraft, which could extend Soviet detection of penetrating bombers by a considerable distance. Even with-

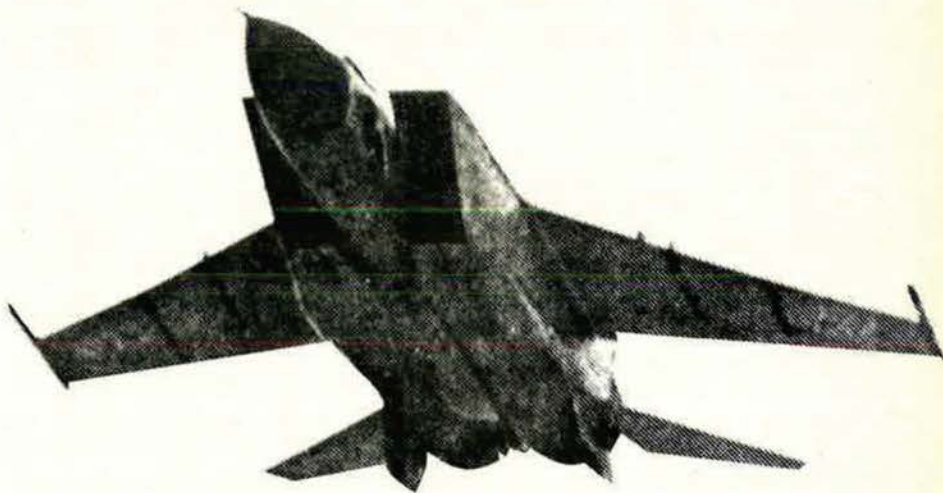


Blinder

out advanced technology, it could probably detect low-altitude aircraft against the background of a calm sea. In any event, the AWACS could further complicate our bomber penetration problems.

The fighter-interceptor inventory is at an impressive level of more than 3,000 aircraft. Some of them are older aircraft—1950 versions—but most, including the MIG-17, MIG-19, and MIG-21, are still ef-

fective aircraft and have good all-weather capability. Production continues on the MIG-21, which is employed throughout the Communist sphere of influence. This aircraft may be equipped in the future with radar



Foxbat

and armament to attack low-altitude aircraft. We believe it was recently deployed as an air defense interceptor and may have a tactical role in the future.

A dynamic modernization program has seen the introduction of a new fighter aircraft about every eighteen months, and in the past five years, three new fighters have become operational. One of these is the Fiddler, a large, long-range in-

ceptor that could be a perfect complement to the AWACS. Another is the Flagon, a small, fast, point-defense interceptor that has been in service for more than two years. The Foxbat, a long-range, Mach 3 class fighter, has established several speed, payload, and altitude records and still holds two official world speed records over a closed-circuit course. This aircraft may be equipped in the future with radar

Surface-to-Air Missiles

The fighter-interceptor force is supplemented by an extensive deployment of surface-to-air missile (SAM) systems—on the order of

10,000 launchers—again illustrating the Soviet penchant for massive firepower. Besides numerous anti-aircraft artillery weapons, the Soviet Union has literally thousands of surface-to-air missile launchers in both fixed and mobile configurations. In accordance with their policy of retaining older, proved systems, the SA-1, designed for defense against mass raids such as occurred in World War II, is still deployed around Moscow.

The backbone of the SAM defenses in the Communist world, however, is the SA-2. This medium-to high-altitude system has been spread throughout the Soviet Union and pro-Soviet nations, including Cuba, China, North Korea, North Vietnam, and the United Arab Republic. The SA-3 has better low-altitude characteristics and thus provides an excellent complement to the SA-2s.

In addition, the Soviets also have mobile SAM systems—the SA-4 and SA-6—which are ideally suited for defense of army field units. The one remaining system—the SA-5 Tallinn system—provides an excellent defense against high-speed, high-altitude aircraft. It also has the inherent potential to intercept ballistic missile reentry vehicles. The deployment pattern for the SA-5, as we know it, adds very little to the SA-2/SA-3 coverage against the sort of air attack we can mount. We in SAC believe this to be a strong argument that the SA-5 Tallinn system was deployed with a dual purpose in mind: air defense and ballistic missile defense. This thesis will be developed further in the discussion of Soviet ballistic missile defense.

Antisubmarine Warfare

The Soviet Union has declared its intentions on and beneath the high seas as illustrated by a well-documented naval production program. The naval exercise Okean in 1970, which was the widest in scope ever attempted by any navy, and displays of naval presence in the Mediterranean and Caribbean Seas are well known. Less well known, perhaps, are the two large helicopter carriers—*Moskva* and *Leningrad*. These ships carry sophisticated electronic gear for detection and track-

ing of submarines, and armed helicopters to attack undersea vessels.

In addition to the helicopter carriers, the Soviet Union has developed several long-range, land-based aircraft for the antisubmarine warfare (ASW) mission. These aircraft probably are equipped with a high-resolution radar and magnetic anomaly detection equipment, using torpedoes and depth charges as weapons. The long-range naval version of the Bear bomber could also be used for the ASW role. With such an aircraft recovering in Cuba, as has already been done with the reconnaissance version of the Bear, it would be possible to cover the entire North Atlantic in a routine fashion.

Ballistic Missile Defense

The third portion of the Soviet Union defensive system is ballistic missile defense, where there is considerable activity under way. The deployed Moscow system consists of sixty-four launchers in four complexes, supported by several radars. Dr. John S. Foster, Jr., the Department of Defense Director of Defense Research and Engineering, described this system as a "relatively complete ballistic missile defense," and also stated that there is "no reason to doubt the effectiveness of this system."

About five years ago, construction began on extremely large and powerful early-warning acquisition and tracking radars designated Hen House. This is a giant radar, approximately 900 feet long and ninety feet wide, providing early-warning acquisition and tracking functions. A new acquisition radar, known as Dog House, stands hundreds of feet tall and provides refined data for improved battle management. Final target tracking and missile guidance probably is provided by large, dome-covered tracking radars known as Try Adds at the four Moscow sites.

The interceptor weapon associated with the Moscow ABM system is a multistaged missile designated Galosh. It probably has a range of several hundred miles, can carry a nuclear warhead of one to two megatons, and appears suitable for a high-altitude area defense. As now deployed, it could give the Soviets some capability against Minuteman

or Polaris missiles on northern trajectories. Completion of this entire system is still two or three years away, when the half dozen Hen House installations around the Soviet Union are operational.

However, some estimates do not limit the ABM missile inventory to just the Galosh, since the SA-5 Tallinn system has the potential of a second system. It has been pointed out that it could have considerable capability in making successful intercepts of incoming ballistic missiles if the system is given information from the aforementioned large ballistic missile acquisition and tracking radars.

In addition, extensive research, development, and testing of new and improved ABM components is under way. The sum total of these efforts indicates that by the mid-1970s the Soviets could have 2,000 or more ABM launchers defending all important industrial areas in the Soviet Union.

Soviet R&D

Underlying this strategic buildup, which has been accomplished in an incredibly short time, is a dynamic research and development program efficiently managed and adequately funded. Again quoting Dr. Foster, "The Soviet Union is now about to seize world technological leadership from the United States." The basis for his conclusion is the comparative state of technology between the two nations and the current level of research and development efforts. The United States still retains an edge in overall technology, but unfortunately this edge may exist in nonessential or irrelevant areas.

Three features characterize research and development practices of the Soviet Union. (1) They are bold in their approach to program concepts. Construction on the large Hen House radar, for example, actually began several years before a working interceptor to complement it became available. (2) The Soviets organize their system development around a few prototypes, most often pitting two teams of designers against each other. The wide variety and variations of USSR fighter aircraft are examples of this methodology. (3) They seldom abandon a proved piece of equipment

or system, but instead, rebuild or modify it to improve its usefulness or extend its life. Prime examples of this are the numerous modifications made to the Bear heavy bomber and the versatility of the SS-9 missile.

Allocation of funds and qualified personnel indicates heavy emphasis on research and development. Soviet efforts in defense-related R&D have exceeded those of the United States. The Soviets have expanded their research, development, test, and engineering (RDT&E) budget annually by ten to thirteen percent while the United States RDT&E budget has remained essentially constant. Looking at military, space, and atomic energy R&D, the US is already behind about \$3 billion a year.

The production from this Soviet effort is phenomenal, and has had disquieting results in at least three major military areas. The Soviets have publicly flown twenty-five prototype bomber and fixed-wing, support-type aircraft in the past sixteen years. The regularity of their production output is amazing and apparently quite unaffected by the high-priority missile and space programs. In the last twenty years, fifteen fighter systems have been developed. All have flown at least in the prototype stage and have been seen in public. Since 1957, the Soviets also have designed and tested a total of eight defensive ABM and SAM missile systems. The emphasis on development, initiation of programs, and competition between systems is evident.

Communist China

By far the gravest military threat to the United States today is posed by the Soviets' massive strategic power. However, one must also keep an eye on the emerging threat from the Chinese Communists. The Chinese apparently are convinced that the possession of a strategic nuclear strike capability will greatly enhance Red China's bargaining position throughout the world.

As a step toward attaining this goal, the Chinese thus far have achieved a modest nuclear capability. They have conducted nuclear testing since 1964, totaling eleven detonations. Several have been thermonuclear devices, including both air- and, possibly, missile-delivered

weapons, with yields in the megaton class.

They are working hard on all forms of delivery systems. The Chinese have successfully orbited two satellites, one in the spring of 1970, and one in March of this year. The technology displayed in launching these nearly 400-pound payloads provides an insight into their missile potential. Based on their demonstrated space technology, the start of ICBM testing could occur at any time. Following testing, an operational ICBM could become available as early as 1973 and could be deployed in limited numbers (ten to twenty-five) by late in the decade.

A parallel potential exists with mid-range ballistic missiles. Although the Soviet Union provided MRBMs in the early 1960s, the Chinese have been testing their own designs. It seems likely that they have developed an indigenous missile, and limited deployment could have begun already. A force of eighty to 100 MRBMs could be available by 1975. Emphasis in their missile research and development appears to have shifted last year to the development of an IRBM. This system could be operational within one or two years.

The present Chinese nuclear-capable delivery force consists of a limited number of medium-range bomber aircraft. These bombers include about ten B-29 type piston aircraft acquired from the Soviet Union in the late 1950s. They also have a small but growing jet-powered medium bomber force of Chinese-produced Badgers.

Communist China's air defense is a vintage version of the USSR's, with 3,000 fighter aircraft, mostly of Soviet design. Indications are that they may now be producing domestically designed fighter aircraft. A radar network supporting these fighters consists of nearly 1,500 air defense radar sets. In addition, key targets are protected by more than fifty surface-to-air missile sites and nearly 4,500 anti-aircraft weapons.

While growth of the strategic forces of the Chinese Communists is hardly comparable to Soviet growth, the threat they pose does include improvements in all areas. The medium-range bomber force

is expected to continue to grow at a modest rate. Missile deployment may have begun last year with MRBMs, followed by IRBMs, with an ICBM at the earliest by 1973. By the mid-1970s, total missiles on hand could reach as many as 125.

The Growing Threat

In summary, there is no doubt that the threat is growing. The Soviets are testing improvements for three types of ICBMs and may be deploying a completely new system. Steady growth is also evident in the submarine-launched ballistic missile force, and testing is under way of a new sub-launched missile that could double the range of the current missile. They continue to maintain a large strategic bomber force, and a new bomber is undergoing extensive testing.

Although the Soviets already have superiority in all stages of air defense, they are deploying improved surface-to-air missiles, fighter-interceptors, and are working on anti-submarine and ballistic missile defenses. Finally, they are striving to build the world's finest technological base to support their expanding research and development program, which will provide them with options for the future.

The Chinese Communist efforts to attain an independent strategic force only complicate the problems facing the United States.

The impact on the United States and its overall strategic posture is at least threefold: First is the threat to the US Triad of strategic forces, in their daily posture, from the Soviet ICBMs, SLBMs, and antisubmarine warfare forces. Second, the penetration of defenses becomes increasingly difficult, for both US bombers and missiles. Finally, the enlarging and more complex strategic offensive and defensive system complicates the deterrence task of our strategic forces.

This article has focused on the strategic threat—offensive and defensive—but Soviet developments in tactical air, land, and sea forces are equally imposing. They have built an impressive force covering the full spectrum of warfare. Coupled with emerging Chinese military power, the threat to the United States is ominous and growing. ■

In current appraisals of Western Europe's ability to defend itself militarily, the dangerous situation that has evolved in the Mediterranean area has received the lion's share of attention and concern. However, also critical to the security of the Western alliance are the approaches from the north, which in tactical terms can be considered equally important. In this article, AIR FORCE Magazine's Editor for Europe draws a gloomy profile of the forces guarding . . .

NATO's Northern Flank—Vital

By Stefan Geisenheyner

AIR FORCE MAGAZINE EDITOR FOR EUROPE



Clad in cold-weather combat gear, and sporting a down to business necklace, is a young member of Norway's Arctic Brigade. The Brigade is part of the force guarding the North Cape region of NATO's northern flank.

WHILE most Western leaders openly voice concern about the rapidly deteriorating military situation in the Mediterranean region, little or nothing is being said about the equally grave picture that has developed during the past decade on NATO's northern flank.

Britain, Denmark, Norway, and West Germany—NATO's northern forces—are faced with a difficult defensive task that has to be accomplished against overwhelming Warsaw Pact strength on land, at sea, and in the air.

According to some experts, the power gap between East and West in the northern region has widened to the extent that the credibility of NATO's all-important deterrent posture is in jeopardy. German military sources say that the West is trying to defend the northern flank with three divisions, 150 ships, and about 200 combat aircraft. These forces are

opposed by twenty divisions, 1,100 ships, and at least 500 aircraft.

The broad term, "northern flank," applies to the southern littoral of the Baltic Sea, which includes the coastlines of Germany, Denmark, and its Baltic islands; the Norwegian coast from Oslo to the North Cape; and, finally, the approximately 100 miles of land frontier between the USSR and Norway, located far above the Arctic Circle, west of Murmansk.

The strategic value of this northern flank rests on two vital anchors. The first is NATO's blocking position in the western Baltic, which serves to contain the Soviet Baltic Sea Fleet. The second is the North Cape region, stretching from Narvik to the Soviet border. NATO forces in that area would counter any Soviet thrust toward the west



A strong crosswind adds to the difficulty of takeoff at this desolate airfield in the Arctic. Beside any flesh-and-blood enemy that may be encountered in the north's frozen climes, another, and very real, opponent is one the Russians call "General Winter."

But Increasingly Vulnerable

through northern Norway. They also could threaten Murmansk, the USSR's only year-round, ice-free harbor in the west with free access to the open seas. The Norwegian coastline between these two anchors is of only minor strategic value.

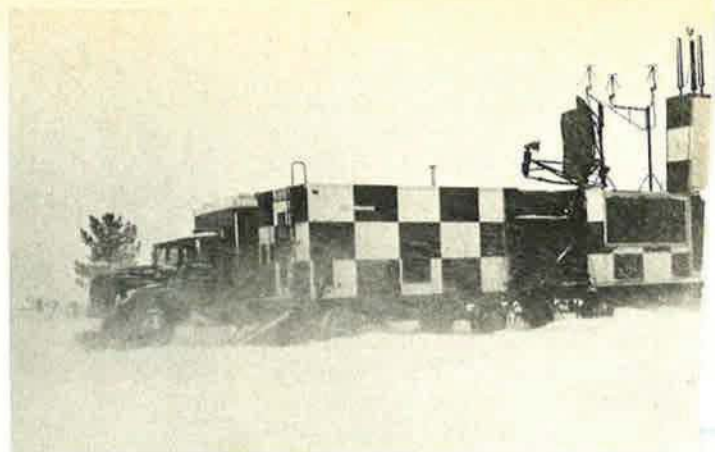
If one of the two anchors should fall to military pressure or be bypassed politically, the northern flank of NATO would collapse. Should the North Cape region fall, the very powerful Soviet fleet stationed in the Murmansk area would have unhindered access to the open sea and, with the help of landing operations, could neutralize Norwegian coastline defenses. This, in turn, would threaten the British Isles—the same way Britain was threatened during World War II when the Germans held Norway. Should the Baltic defenses fall, the Soviet fleet in that sea could break out and cut NATO lines of communication to the north,



Heavier units of the German fleet have been assigned to the Northern Sea Command. Here, modern German Navy destroyers Hamburg and Schleswig-Holstein participate in formation exercises conducted on the high seas.



For air defense, the Royal Norwegian Air Force relies heavily on its force of Northrop F-5s. Joint operations in the north involve US, Germany, Britain, and Norway.



An Arctic blizzard strikes GCA unit at Bardufoss Station, Norway, set up by USAF's 2d Mobile Communications Group to test operations in extreme weather.

which would isolate and collapse the North Cape defenses.

The same military situation existed during World War II when the Germans blocked the Baltic and the approaches to Murmansk. Allied convoys were constantly harassed, and the German defenses did not collapse until 1945. As a result, Soviet forces were denied a major role in the western theaters of war.

Today, however, the situation is vastly different. The Soviets learned much from the World War II experience. In another war, they would have a good chance of breaking out into the open seas. Their numerical and qualitative superiority is so pronounced that they would not have to rely on tactical nuclear weapons to reach that goal. The defensive task of NATO is complicated by the fact

that neither Denmark nor Norway permits the permanent stationing of foreign troops or the storage of nuclear weapons on their territory.

The Northern Anchor

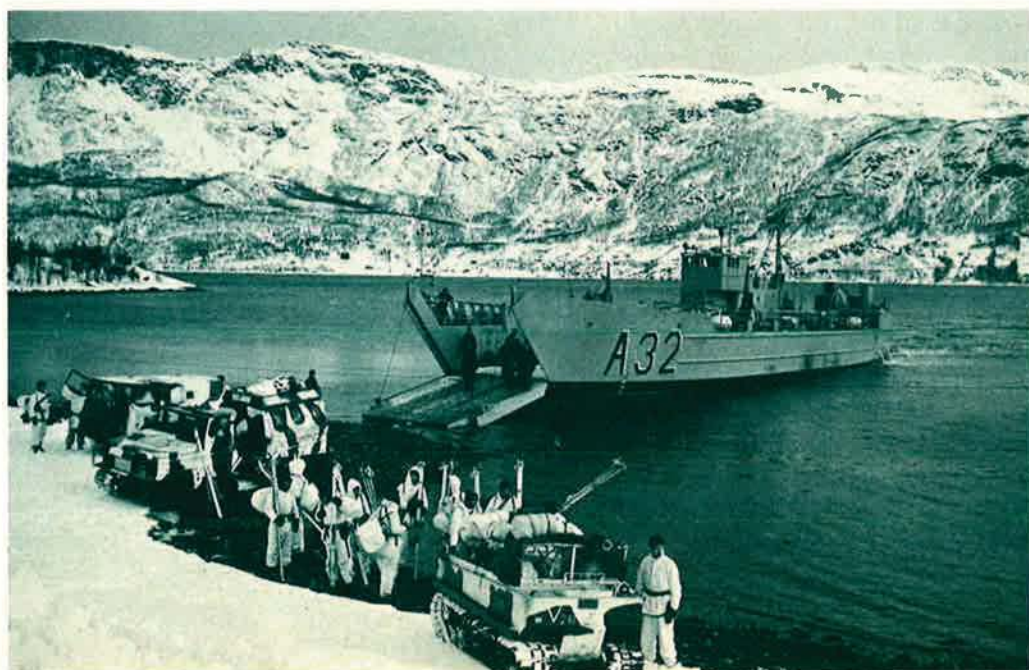
The Soviet navy has fleets stationed in the Far East, the Black Sea, the Baltic, and the Arctic. The Arctic Fleet is the most modern and the largest, consisting of cruisers, destroyers, motor torpedo boats (MTBs), and landing craft. The majority of the submarine fleet is stationed at Murmansk and at other harbors in the White Sea, and a strong tactical air force supports several infantry and armored divisions in the Murmansk region. The exact strength of the naval forces there is not known, but is believed

to consist usually of five to six cruisers, forty destroyers, and about 150 submarines. The ground troops are estimated at 50,000 men. The whole Murmansk region and the approaches to it are well defended by missiles and a tight radar network.

By comparison, NATO strength is quite limited. One brigade of Norwegian mountain troops is located at Kirkenes, with the major operational mission of fighting guerrilla-type delaying actions that would provide time for the main line of defense north of Tromsø to be manned by troops flown in from the south. The strength of this brigade is now at about 6,000, supported by an estimated fifty aircraft and a number of MTBs.

The Tromsø line, however, is basically indefensible. It can be as-

Troops conduct an exercise in a Norwegian fjord above the Arctic Circle. Age-old and modern techniques—in the form of skis and tracked snowmobiles—are used to conquer terrain and the ever-present difficulties that training in a hostile climate entails.

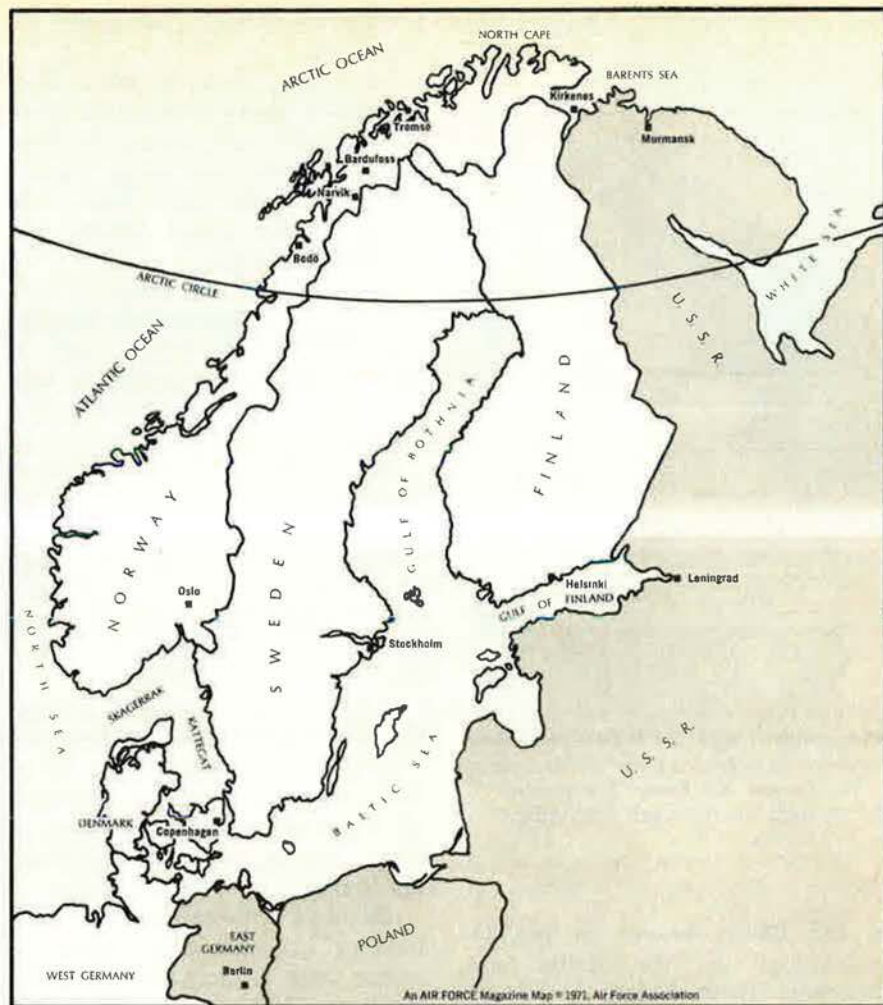


sumed that in case of war the Soviets would strike over land and by air through northern Finland, or possibly Sweden, toward Narvik, thereby bypassing the North Cape and Tromsö defenses. Such a military envelopment is taken for granted by NATO's military planners. The biannual maneuvers, called "Arctic Express," are designed to develop tactics to counter such a thrust from the east through Sweden, and from the north along the coastline against the Tromsö main line of defense. "Arctic Express" involves airlifting an international strike force from the south, supported by strong air and naval forces.

These defensive measures serve to protect the airfields available in the Narvik, Tromsö, and Bodö regions. They are vital to NATO because only airpower can block the sea lanes to Murmansk. Relatively powerful Norwegian Air Force elements are permanently stationed in the region, with the task of surveillance of the Arctic Ocean and Barents Sea and, in case of war, neutralization of the Soviet Arctic Fleet. The local air forces are not strong enough to accomplish this goal, but the threat alone would severely hinder free movement of the Soviets. Here, too, help from the south would be needed. The major air bases at Bodö and Bardufoss are used regularly by aircrews from the south who fly practice missions to the north. It is not unusual for USAF Phantoms, British Harriers, German Starfighters, and Norwegian F-5s to conduct joint operations above the Arctic Circle.

Logistics

Obviously, successfully defending the region hinges on an uninterrupted flow of supplies from the south. Due to the lack of road or rail connections through central Norway, supplies would have to be airlifted in or arrive by ship. The ability to defend these logistic lines is essential to the deterrent posture at the North Cape. Britain, Denmark, Germany, and Norway have, therefore, allotted relatively strong naval and air forces for this task. Germany has gone so far as to withdraw all its destroyers and frigates from the Baltic and reassign them



As indicated by the map above, the problems presented in planning any cohesive defense of NATO's northern flank are awesome. With the broken land masses and inhospitable terrain acting as a check to the movement of large-scale ground forces, strong emphasis is being placed on interdiction of the sea lanes and aerial defenses.

to the Northern Sea Command, which is responsible for the security of the supply line to the north.

The exact strength of these protective forces has not been made public. It can be assumed, however, that major parts of the British and Norwegian air forces are engaged in this task. Ten to fifteen frigates and ten destroyers, at most, from Britain, Norway, Denmark, and Germany are available to secure the sea lanes to Narvik. This force is far from sufficient. Most experts believe that the Soviet fleet located at Murmansk would cut this NATO protective screen to ribbons by sheer quantity, if allowed to break out from the White Sea region. The NATO forces permanently stationed at the North Cape are not strong enough to prevent such a Soviet breakout.

NATO politicians are reluctant to allow public disclosure of these mat-

ters. In 1969, a British TV team produced a documentary about NATO's northern flank. The newsmen received the wholehearted cooperation of the military, who could finally discuss its problems openly. Or so they thought. The film may have been a far too critical assessment of the situation and, though endorsed by the commanding general of NATO's northern forces, was banned for security reasons by the alliance's Secretary-General. Even today, the film's contents remain under security wraps. To some, it seems shortsighted to suppress the realities about the dismaying situation at the North Cape; nobody is more aware of the realities there than the Soviets.

The Southern Anchor

The other anchor of the northern flank is located at the western exit



The advanced Saab 35XD Draken fighter-bomber has begun to enter the inventory of the Danish Air Force. Forty-seven of the aircraft are currently on order.

of the Baltic, known in NATO terminology as the Baltic approaches. These include Denmark and its Baltic islands and the short stretch of the West German coastline from Denmark to the East German border. This defensive line makes up only five percent of the Baltic's total coastline. About sixty percent of the coastline is shared by Sweden, which is strictly neutral, and by Finland. The latter, though neutral, is liable to be occupied by the USSR in case of conflict.

The Russo-Finnish peace treaty of 1947 stipulated that the Soviets would intervene if Finland were threatened. Past Soviet actions, in particular those regarding Czechoslovakia, leave small doubt that Finland would be occupied if the Soviets deemed it necessary. The remaining coastline of the Baltic belongs to the USSR and its allies, Poland and East Germany.

Soviet influence in the Baltic has expanded tremendously since World War II. At the start of that war, the USSR owned only sixty miles of Baltic coastline, in the Leningrad region. During the past thirty years, the Baltic has become, in fact, a Soviet-dominated inland sea. The forces available to secure, and if

possible to increase, these gains are substantial.

At present, the Soviet Baltic Fleet consists of three missile cruisers, ten missile destroyers, twenty-six conventional destroyers, thirty frigates, sixty-five missile patrol boats, 130 conventionally armed MTBs, and seventy submarines.

In addition, an amphibious force consisting of several marine divisions and 300 to 400 landing craft is available. Almost unlimited air support can be called on from nearby mainland Russia.

Soviet defensive forces are just as formidable. They consist of a tight radar network and associated anti-aircraft defenses, which would make counterstrikes most difficult and costly. These forces are augmented by the air, naval, and land forces of East Germany and Poland.

NATO has very little to counter this threat and, above all, to create a credible deterrent posture. As in the North Cape region, the defenders of the Baltic are outnumbered in every respect, at a ratio of about ten to one.

Denmark's forces consist of four infantry brigades with supporting armor and artillery elements. Its small navy has two frigates assigned to the Northern Sea Command and sixteen MTBs in the Baltic. The Danish air force has 112 combat aircraft, at least one-third of which are obsolescent. All these forces are assigned to NATO and cooperate closely with the Germans.

The West Germans contribute their MTB fleet of forty boats plus about sixty minesweepers to defend the Baltic approaches. A naval air arm of about 150 F-104G Starfighters, helicopters, and transports is available to support overwater operations. One armored division with its supporting tactical air force elements has been earmarked for shore defense. These forces are obviously inadequate to contain opposing Soviet forces.

Gen. Kurt Ramberg, the Danish Chief of Staff, gave a realistic assessment of the defense situation in the Baltic, in a November 1970 speech. He said that Denmark would not be able to defend against even the first wave of a conventional attack. Allied reinforcements, therefore, would not have time to come to Denmark's aid before that country was overrun by the enemy.

Sweden

One factor that plays a significant role in NATO planning, and assuredly also in Soviet strategy, is the strong military presence of Sweden in the center of the northern flank. That nation's strict adherence to its neutralist policy is, in some ways, an asset to NATO and a liability to the USSR. The geo-strategic location of Sweden blocks the Soviet approaches to Baltic defenses and to the North Cape. The attacker would have to take, in both cases, a roundabout way to reach his goal. Even if



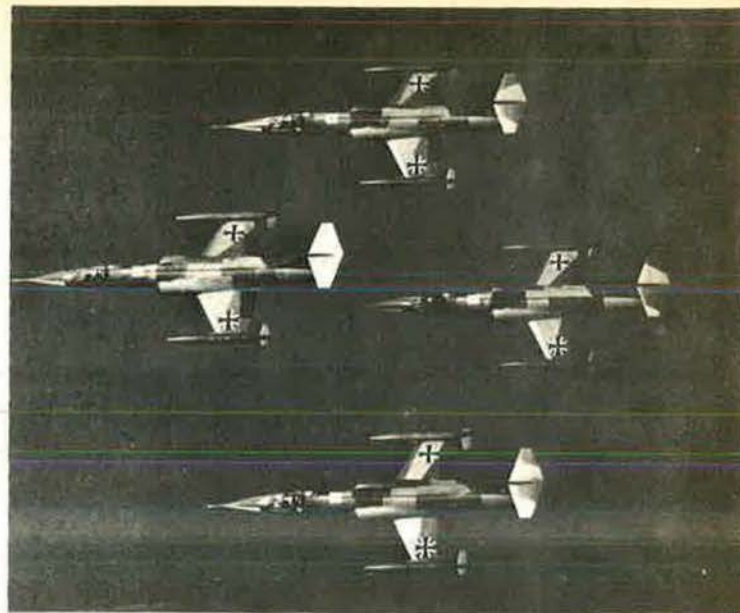
Patrolling the Baltic is a force of German Navy motor torpedo boats (MTBs). While believed by many experts to be far outdated technologically, the MTBs currently constitute the major segment of NATO's seaborne defensive effort in that area.

he succeeded, he could by no means be sure of Swedish intentions. That nation might decide to join the battle after all, to defend itself from complete encirclement by the Soviet Union. If Norway, Finland, and Denmark were under Soviet rule, Sweden would be cut off from the West and could no longer exist as an independent nation.

In any event, the possible Swedish actions and reactions remain a mystery to both NATO and the USSR. Sweden has made it clear that it will not tolerate any foreign activity on its soil, and has considerable capability to support this policy. Any aggressor must thoroughly consider the possible implications before attacking Sweden, the strongest power in northern Europe. Its air force is one of the largest in the world, with about 800 combat-ready, technically advanced fighters. Its coastal defenses are exemplary, the navy is modern, and the army boasts some of the best equipment the state of the art can offer. In addition, the Swedish population is politically stable and reliable.

Even the USSR would not want to get unnecessarily involved with Sweden as it surely would if it were to drive toward the Tromsö defense line through or over Swedish territory. On the other hand, a successful Soviet attack against Sweden alone, who cannot officially count on any help from her Scandinavian neighbors, would automatically collapse NATO's northern flank. A Soviet-

Despite the accident-plagued history of Germany's F-104G aircraft, the force continues as a factor in the basic equation of air defense. Here, camouflaged F-104s of the German naval air arm huddle in tight formation flying.



occupied Sweden would result in the opening of the Baltic straits, and thereby make NATO defense positions at the North Cape untenable.

It seems reasonable, therefore, to assume that if a war should break out, Sweden would be involved. If that nation were attacked by the USSR, for whatever reason, NATO would be forced to intervene in order to protect its own interests. However, such speculation cannot play a role in NATO's military planning. It has to be assumed that Sweden would remain neutral and able to defend its territory without taking sides.

Serious Situation

The situation on NATO's northern flank is serious because of the numerical weakness of the alliance's northern forces. This fact has not yet been brought forcibly to the attention of the Western world, whose major concern is directed toward the southern flank. The defensive positions in the north depend completely on the fast arrival of outside help in case of war.

The feelings of the defenders are best summed up by a statement of German Admiral Jeschonnek in 1969: "In view of the power gap, the defenders would fall prey to hopeless defeatism if the assurance was not available that they are backed by the powerful fleets of the Atlantic allies." This statement was made two years ago. Today, it remains doubtful if NATO's defensive forces at North Cape and the western Baltic could hold out long enough for help to arrive.

In NATO's southern region, Soviet tactics are primarily political. In the north, the pressure is of a military nature and is growing greater by the year. If nothing is done to strengthen the northern defensive positions, they will become militarily useless in the near future. When that point is reached, they will no longer fulfill their primary deterrent purpose. That would be almost as advantageous to the Soviets as would the actual physical elimination of NATO's northern defenses. ■



Sweden has developed an up-to-date array of military hardware in the interest of self-defense. Here, a Saab-developed Viggen patrols the northern skies. While Sweden is neutral, its strategic and military importance can't be discounted by NATO planners.

At 0900 hours on July 1, 1946, a task force of 42,000 men, along with 120 reporters, braced themselves for the most spectacular weapon test ever staged—an atomic detonation over the target fleet assembled at Bikini atoll. Later that month, an even more awe-inspiring underwater shot took place. The influence of these tests on military thought was perhaps more subtle and long range than immediate, but a significant chapter of nuclear-age history was written at . . .



By Col. Kenneth L. Moll, USAF

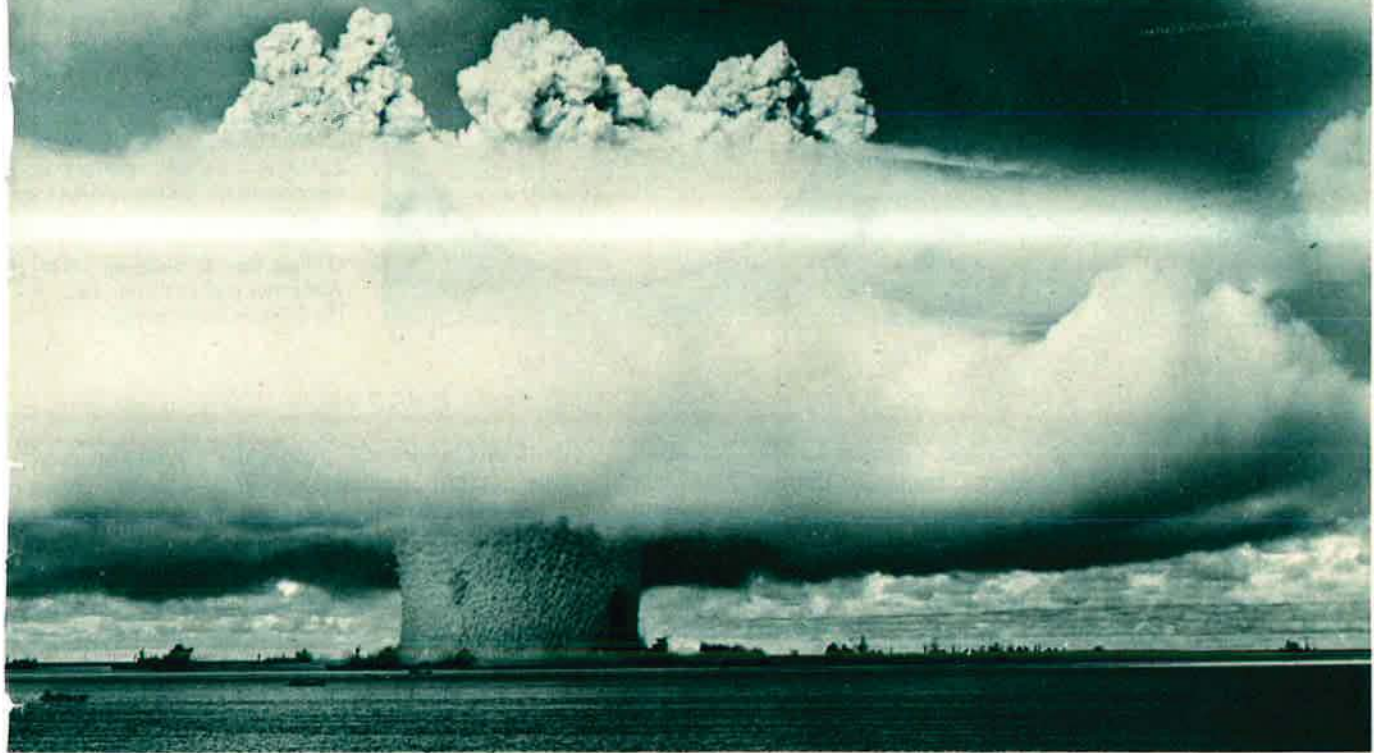
The author, Colonel Moll, has written widely on military history and strategy. This article, his third for AIR FORCE Magazine, was prepared while 1970–71 USAF Research Associate at the Washington Center of Foreign Policy Research. A 1950 West Point graduate, he flew F-80s in Korea and T-39s in Vietnam, and has served in ADC, SAC, and the JCS. He assumes Air Staff duty this month, as Chief, Coordinated Action Plan Div., DCS/Plans and Operations, Hq. USAF.

BUT FOR Operation Crossroads, the word “bikini” would not have entered our everyday vocabulary. And the bikini, that ultimate achievement in functional economy, would be known by some other name, of less explosive imagery.

Twenty-five years ago this month Bikini atoll, a dot on the map of the Pacific, some 2,000 miles southwest of Hawaii, rose to world prominence as the site of the “Able” and “Baker” atomic-bomb tests. These two nuclear detonations—the world’s fourth and fifth—probably were the most photographed events in history up to that time. The tests were truly a crossroads in the paths of our national security strategy and of aerospace power.

The idea of testing an A-bomb’s effects against naval vessels was a natural to Manhattan Project scientists as early as 1944, before the first bomb was tested at Alamogordo, N.M., in July 1945. Shortly afterward, at Potsdam, Army Air Forces Gen. H. H. Arnold suggested a postwar test using an A-bomb “sunk hun-

RATION CROSSROADS



There were no words in the vocabulary of the day to describe the underwater Bikini shot. On the right of the mushroom stem is the "shadow" of the battleship Arkansas, at first believed to have been lifted hundreds of feet into the air.

dreds of feet in the mud" beneath an evacuated Japanese harbor. After Hiroshima and Nagasaki, similar ideas occurred to many others.

When the Chief of Naval Operations, Adm. Ernest J. King, recommended routine destruction of the Japanese fleet, General Arnold counterproposed to the Joint Chiefs of Staff that a number of Japanese ships be made available to the AAF for A-bomb and other tests. Admiral King, suggesting air and underwater A-bomb tests against modern vessels, agreed, if the JCS were put in control.

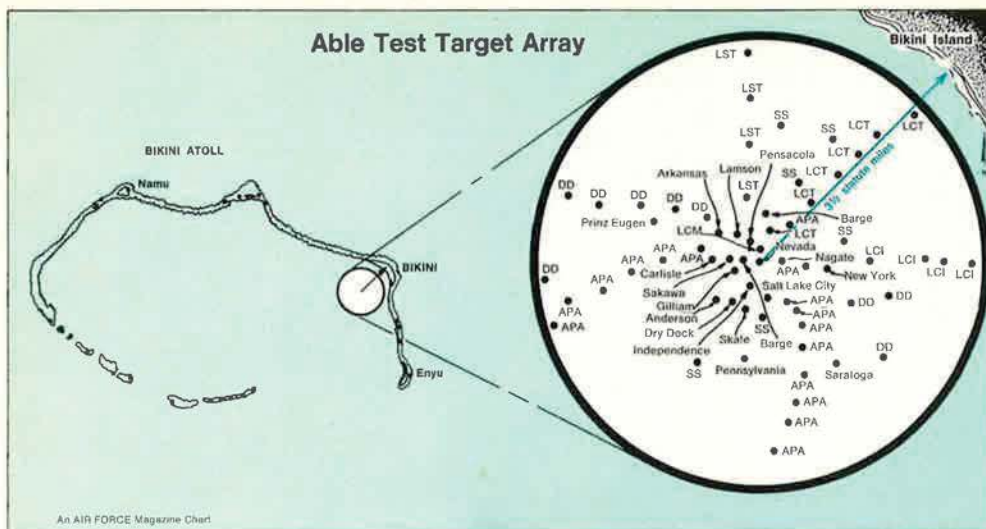
Nothing like it had been tried since 1921, when Gen. Billy Mitchell—over Navy objections—bombed and sank the former German battleship *Ostfriesland* in tests off Old Point Comfort, Va.

In late 1945, the AAF was heralding air-power and the A-bomb as the weapons of the future. The Navy and its Secretary, James Forrestal, pointed to World War II, claiming that "in the future, as in the past, the key to victory . . . will be in the control of the seas and the skies above them."

To ensure that the tests would be fair, the JCS appointed the "LeMay Subcommittee" to plan the operation. Headed by Maj. Gen. Curtis E. LeMay and including Commodore W. S. Parsons (the Navy weaponeer aboard the *Enola Gay*, the B-29 that dropped the bomb on Hiroshima), the subcommittee settled such questions as who should command the tests and whether or not the ships should have full fuel and ammunition loads.

Brig. Gen. William F. McKee, Maj. Gen. Curtis LeMay, and Maj. Gen. Earle E. Partridge discuss plans for Crossroads. General LeMay was later USAF Chief of Staff. General McKee became USAF Vice Chief of Staff, and General Partridge subsequently commanded NORAD.





Target vessels at Bikini for Test Able included four US battle-ships—the Arkansas, New York, Nevada, and Pennsylvania—the cruisers Pensacola and Salt Lake City, the Japanese battleship Nagato and light cruiser Sakawa, and the German Prinz Eugen. The aircraft carriers Saratoga and Independence were also target ships, as were twelve destroyers (DDs); eight submarines (SSs); seventeen landing craft (LSTs, LCIs, LCTs, and LCMs); nineteen merchant-type vessels (APAs and APs); two barges, and a concrete drydock. The APAs Gilliam and Carlisle, the DDs Anderson and Lamson, and the Sakawa were sunk.

On one occasion, General LeMay personally visited President Truman to discuss AAF fears about the fairness of the tests. The subcommittee resolved the issues, and the detailed plan was endorsed by the JCS and the President. Vice Adm. W. H. P. Blandy, naval ordnance specialist, was named Commander of Joint Task Force 1.

Preparations

Plans for "Operation Crossroads" were revealed publicly by Admiral Blandy on January 25, 1946. There would be three air and underwater shots, beginning early in May of that year. In the 1946 post-World War II/pre-Cold War environment (readily comprehensible in the mood of 1971), resistance to the tests was fierce. One Senator badgered Admiral Blandy with fears that such a test would set off a "chain reaction" in the atoms of water, blow up the entire ocean and with it the world. Admiral Blandy politely assured the Senator that scientists associated with the project had no such fears. Others foresaw cracking of the earth's crust, a tidal wave sweeping across the Pacific, or water pressures so great they would kill all fish for thousands of miles.

Scientists, suffering guilt over the A-bomb, opposed Crossroads as "saber-rattling" that would impede such international atomic-control efforts as the Baruch Plan.

The Secretary of Commerce, Henry Wallace, wrote to the President that the tests were controlled by the military and hence would only reach the conclusions that the military wanted. Others agreed that it was atrocious to be giving thought to atomic warfare and that, anyway, the tests would cost far too much money.

Mr. Truman, perhaps not completely confi-

dent of Crossroads' objectivity (even the AAF was not too sure at this point), weighed things carefully. According to *The Forrestal Diaries*, the President told military and cabinet leaders in February that he had "to be sure that this test met all of the crackpot criticism and that not only would it be objective, but we had to convince the public it was objective." He therefore appointed his own Evaluation Committee, to observe Operation Crossroads.

Suddenly in March, with preparations well under way for a May 15 shot, Secretary of State James Byrnes asked for a postponement. He feared Crossroads' effect on the disturbed world situation. Forrestal opposed Byrnes, protesting that 20,000 men already had been collected and engaged for two months. Nevertheless, on March 22, the President ordered the tests to be postponed for about six weeks, thereby providing the military and the scientists some much-needed extra time.

But the tests could not be delayed very long. Military manpower was leaner every day because of the drastic postwar demobilization. Technical support came largely from the fast-collapsing Manhattan Project, which had already lost most of its top scientists and was essentially in caretaker status, awaiting turnover to the Atomic Energy Commission, which did not take place until January 1, 1947.

Crossroads was a massive and ambitious undertaking, calling for an incredible amount of training, preparation, and coordination. By July, it included 42,000 men—ninety percent of them Navy—who had to be trained and transported two-thirds of the way across the Pacific.

Complicated preparations were needed to collect data on such factors as pressure, shock, wave motion, electromagnetics, and radiation.

The 280-square-mile Bikini lagoon had to be swept of Japanese mines and cleared of coral heads, then precisely charted. Vast construction was needed on Bikini and other islands.

There were hundreds of other problems to be solved by Joint Task Force 1. There was, for instance, the problem of what to do with King Juda and his tribe of 161, who lived on Bikini atoll. The tribe agreed to move temporarily to Rongerik, 128 miles away. Seabees helped them construct a new church, community house, and shelters.

But Rongerik turned out to be barren and inhospitable, and in 1947 the natives were moved again, to Ujelang atoll, while nuclear tests continued at Bikini until 1958. Today, Bikini is at last being prepared for the return of these natives, but it will be several years before it will be ready for all of them. Juda's tribe has now increased to 350.

An even greater public-relations problem was the open press policy. Some 120 reporters, including a Russian, watched the Able shot. (Two Soviet scientists also attended as UN Atomic Energy Commission observers.) The press headquarters ship provided live radio coverage and sent 258,000 words of copy during the first twenty-four hours after Able. As in the more recent Apollo coverage, any disaster would be exposed immediately to the world. None materialized.

AAF training for Crossroads began in January at Roswell Army Air Field, N.M. Col. William H. Blanchard, Commanding Officer of the Air Attack Unit, supervised training and crew selection. Maj. Gen. William E. Kepner was Admiral Blandy's Deputy Task Force Commander for Aviation. Brig. Gen. Thomas S. Power was Kepner's assistant. At Kwajalein, Brig. Gen. Roger M. Ramey commanded the AAF unit of thirteen B-29s, eight F-13s (B-29s converted for long-range photo reconnaissance), and a number of other aircraft, including a dozen C-54s and six B-17 drones. Navy Air included F6F drones, fifteen PBM patrol planes, and assorted photo planes and support aircraft. Altogether, there were 156 Army and Navy aircraft participating in Operation Crossroads. Only one—an F6F drone—was lost.

The biggest effort of all, however, was the huge fleet of 242 target and support ships at Bikini. There were hundreds of tanks, planes, and assorted military equipment to be exposed for testing, not to mention 204 goats, 200 pigs, and 5,000 rats. There were also 25,000 radiation recorders, 5,000 pressure gauges, 750 cameras, and four TV transmitters. And two A-bombs.

Test Able

By late June, all was in readiness. Seventy target vessels were anchored in Bikini lagoon at distances up to three miles from the bull's-

eye—the battleship *Nevada*. Twenty-two target ships carried test animals. All support ships were from ten to twenty-five miles away.

On July 1, 1946, B-29 *Dave's Dream* (named for Capt. David Semple, leading bombardier who had been killed in a B-29 crash at Roswell) took off from Kwajalein at 0555. The pilot was Maj. W. P. Swancutt. Ten other crew members and three observers were aboard. After two practice bomb runs, the final run began. All photo aircraft were in position.

Upon "bomb away," the bomb-bay doors were closed, and *Dave's Dream* turned for a fast getaway.

At thirty-four seconds after 0900 (Bikini time), at an altitude of 520 feet, Test Able's bomb detonated with a force equivalent to 20,000 tons of TNT. In his book *Dawn Over Zero*, New York Times reporter William Laurence described what it looked like from twenty miles away:

... Through the haze I could see a boiling, angry, super-volcano struggling toward the sky, belching forth enormous masses of iridescent flames and smoke, and giant rings of rainbow. . . . It was like watching the birth and death of a star, born and disintegrated in the instant of its birth.

... I saw a reddish-purple ball of fire . . . quickly surrounded by a gigantic spherical envelope of fog. The envelope collapsed with great violence, like a balloon punctured by an invisible hand. Out of it, like a monster hatched from a giant egg, emerged a mushroom-topped cloud. . . .

Subsequent analysis gave a more scientific but equally sobering picture. Within a second, the shock wave had struck the water, depressing the surface several feet. As the blast spread at the speed of sound, a vivid, expanding line marked the area of agitated water.

When it reached the beach almost four miles away, the palm trees shook as in a hurricane.

The Japanese battleship Nagato, seen here as it awaited the tests, was severely damaged by the Baker underwater detonation. The Nagato sank on the fifth night after the test. Nine ships were sunk by the Baker test shot and many others damaged. Most were badly contaminated by radioactivity.





Test Able, an airburst, badly damaged or sank ships within a half mile of the bull's-eye. The twenty-kiloton bombs tested at Bikini have about one-fiftieth the power of a Minuteman warhead, or 1/1,000 the yield of the twenty-megaton warhead that can be carried by the Soviet SS-9 missile.

By the time the shock wave reached the support ships, it had weakened to a dull, low-pitched thud.

The "spherical envelope of fog" described by Laurence was a "Wilson Cloud"—moisture condensation within the suction wave that followed the blast wave. Quickly dying in the less humid higher altitude, after five seconds the cloud was only a two-mile ring on the sea. Five seconds later it was gone.

With a fireball surface temperature over 100,000 degrees Fahrenheit, optical radiation was hundreds of trillions of watts—more than all the electric light bulbs ever made. Yet, to the disappointment of many keyed-up observers, most of the light was filtered out by the moisture (and by the required goggles, found later to be ten times too dark; they cut out 99.997 percent of the light).

The fireball instantly heated a 2,000-foot sphere of white-hot gases, light as hydrogen, with a lifting force of thousands of tons. Cooling as it rose, the mushroom cloud reached an altitude of one mile in twenty seconds, five miles in another two minutes, and seven miles after five more minutes. It attained a diameter of nearly two miles. Beneath it stretched the stem, containing smoke and debris.

After about an hour, the cloud lost its characteristic mushroom shape, though retaining its lethal radiation.

Carefully monitoring radiation, the first manned boats entered Bikini lagoon two hours after the blast and were greeted by a scene of vast destruction. Two merchant-type attack

transports (*Gilliam* and *Carlisle*) and one destroyer (*Anderson*) were missing; another destroyer (*Lamson*) was listing and sank in a few hours; the Japanese light cruiser *Sakawa* was burning fiercely and sank the next day. The carrier *Independence*, a fraction of a mile from the detonation, had a broken flight deck. A submarine (*Skate*) a little further away had lost her superstructure. The battleship *Arkansas* suffered heavy damage and the *Nevada* moderate. Five other ships received major damage.

Ten percent of the tethered animals were killed immediately by blast. Within three months, another fifteen percent had died of radiation.

Two relatively minor mischances proved embarrassing to Admiral Blandy and the AAF. Most serious and for reasons that have never been determined, the bomb had missed its bull's-eye, the *Nevada*, by 1,500 to 2,000 feet. The bomb had burst almost directly over the attack transport *Gilliam*, which was found on the bottom, twisted beyond recognition. Instrumentation was not ideal at this location, but most of the essential information—except for peak pressures—was obtained anyway. Secondly, due to imperfect radio reception and human error, the master signal was sent too late, and rapid-recording instruments failed to acquire certain desired data.

Perhaps because of the master signal delay and hints by some misinformed AAF representatives, the press reported that the bomb detonated three seconds early and too high. Admiral Blandy bluntly denied this, but—contributing to the confusion—he did not concede the major target inaccuracy until nine days after the test.

Essentially, Test Able showed that ships within a half mile of a twenty-kiloton airburst will either be sunk or damaged extensively; beyond three-quarters of a mile, damage will be relatively light. More important at the time, the test tended to confirm for each observer what *he* wanted to believe.

Secretary Forrestal said there had been "relatively unimportant damage," while General Ramey called the shot "a complete and unqualified success." Some saw that one bomb had sunk five ships with terrifying effect; to them, the A-bomb was a decisive new weapon. Others thought it almost a dud; the world had not collapsed, and even in Bikini lagoon, most of the ships received little or no damage.

The public was not very interested in the test or subsequent controversy. Despite the advance publicity and live radio coverage of Able, the *Philadelphia Record*, in a telephone survey, found that the audience listening to Crossroads on July 1 was only a little larger than that tuned to the doubleheader between Philadelphia and the New York Giants.

Box-officewise, *Variety* billed it "zzz-zzz-Pfft-zzz."

Test Baker

Many of the observers quickly departed. Meanwhile, the fleet was rearranged to provide seventy-four targets, including six submarines submerged in the 200-foot-deep lagoon. At Zeropoint was moored the landing ship, LSM-60, equipped amidships with an "altar" and trapdoor for lowering the Baker bomb ninety feet into the water.

The final Baker rehearsal was held on July 19. Good weather was forecast in a week. In the predawn hours of July 25, a few men gingerly lowered the bomb and, crossing her deck for the last time, silently left LSM-60. The control ship began the radio countdown. A split second before 0835, the world's first underwater A-bomb was detonated.

This time observers were not required to wear goggles. What happened was beyond imagination. There was not even a vocabulary to describe it. It took months to reconstruct the events of Test Baker. To describe the phenomena, a scientific conference had to develop entirely new terms, such as bright track, cauli-

flower cloud, water shock disk, water mound, and base surge.

William Laurence's eyewitness impression was that

. . . a gigantic white sun, about ten times larger than the natural sun, jumped out of the waters of the lagoon. . . .

The super-sun quickly exploded into a mass of clouds, and out of the clouds came, first, a quivering mountain, lighted up from within by a dazzling white light. At the summit of this mountain there again appeared a gigantic, boiling, shimmering mushroom. . . . It kept changing in shape, form, and color so rapidly that it was difficult for the human eye and the human mind to grasp it all. . . . Even the official pictures . . . give but a faint appreciation. . . .

For a time it looked as though a continent had risen from the sea . . . a chain of mountains glistening in the sun. Then the mountains were metamorphosed and fused into a giant tree, spreading out in all directions, bearing many invisible fruits deadly to man. . . .

The A-bomb's detonation generated a violent shock wave in the almost incompressible water. This shock wave, tossing small droplets into the air, rapidly spread in a gigantic white ripple.

Almost instantly, the surface of the water began to rise in a "spray dome," and the fireball punched out of the water. For about two seconds, everything was obscured by the Wilson Cloud.

As the fireball's "cauliflower cloud" continued to rise, a huge column of ascending water was revealed. This column, about 2,000 feet in diameter, rose to some 6,000 feet. It contained between one and two million tons of water. Though seemingly solid, its walls were only about 300 feet thick, and the column's total volume was ninety-nine percent air. After about ten seconds, it began to fall back into the water.

A gigantic wave or cloud of mist (the "base surge") then spread like a writhing doughnut over the captive target fleet. Simultaneously, a wave of real water was spreading from Zeropoint. In eleven seconds, it traveled 1,000 feet and was ninety-four feet high, diminishing to six feet at a distance of four miles several minutes later. It caused a fifteen-foot breaker at the beach three and a half miles from Zero-



This picture of the Able shot, taken less than ten seconds after the detonation, shows the Wilson Cloud, now deteriorated into a doughnut ring, with the familiar mushroom cloud rising in its center.

The Baker underwater shot was the most spectacular man-made event of history, up to that time. The size of the Wilson Cloud may be judged from the battleship in the foreground. In today's era of multimegaton warheads, we tend to forget the frightful destruction that can be caused by even a so-called "nominal" twenty-kiloton bomb.



point. Rising two miles, the cauliflower cloud slowly dispersed.

Baker virtually vaporized LSM-60—no large fragments were ever found—and scooped out a million cubic yards of bottom material from the lagoon.

The *Arkansas*, 500 feet from Zeropoint, went down almost immediately. Before disappearing, she slashed a great "shadow" in the rising column—a phenomenon that led some to believe the 26,000-ton battleship had been lifted hundreds of feet in the air. Three of the submerged submarines went the rest of the way to the bottom. Two smaller ships were sunk, and the gallant old aircraft carrier *Saratoga* sank seven and a half hours later. The fifth night after the test, the Japanese battleship *Nagato* also disappeared.

Altogether, Test Baker sank nine ships, compared to the five in Able. Two others were saved only by being beached, and a number received serious damage. Most damage had been caused by the underwater shock wave, which was several hundred pounds per square inch at a half mile from Zeropoint.

Animals aboard the ships suffered very little from shock, but the deadly radioactive mist and fallout resulted in the later, largely painless death of all the pigs. A number of the rats, however, were still alive two months later. Radioactivity contaminated ninety percent of the ships; many could not be approached for several days. The water pressures instantly killed fish throughout the northeast corner of the lagoon, but outside the atoll there was almost no effect on marine life, either from pressure or radiation.

A year later, as shown by the Bikini scientific resurvey, some of the sea life in the lagoon continued to be slightly radioactive. But con-



This aerial photograph of the Test Baker detonation shows the Wilson Cloud, the rapidly advancing base surge, and the "cauliflower cloud" emerging from the spray dome before it assumed its mushroom shape.

trary to expectations and to much science fiction of the period, there was no evidence of mutation or other effects on the reproductive cycle of marine organisms.

Preparations were begun after Baker for the more tentative deep-water Test Charlie. However, for cost and other reasons, there was increasing pressure to cancel it. On September 8, 1946, President Truman announced that the JCS "have concluded that the third explosion, Test C, should not be conducted in the near future." No deep-water test was made until the 1955 Wigwam shot, detonated at a 2,000-foot depth, about 500 miles southwest of Los Angeles.

By September, most of the support ships had started for home. Colonel Blanchard and his B-29s had already returned to Roswell to set up a general A-bomb training program. Remaining target ships were towed to Kwajalein, and brave souls began unloading the old, irradiated ammunition. On November 1, 1946, Joint Task Force 1 was disbanded.

The Navy had hoped to sail the target fleet back home, invincible as ever, but most of the ships simply could not be decontaminated. In 1948, some twenty-five were scuttled near Kwajalein or sunk by gunfire.

A Quarter-Century Perspective

Operation Crossroads was a fair test, and Admiral Blandy did an excellent job. Masses of data were obtained, and the world was given a glimpse of apocalypse. Still, like space launches after Sputnik and moon landings after Apollo-11, Crossroads had a certain anticlimactic aura that led many Americans to prefer baseball games.

This became apparent soon after the Able shot. Senator Styles Bridges said that "public opinion, which held an exaggerated notion of the potency of the atomic bomb, has begun to swing in the opposite direction. This is a dangerous tendency. Some straight talk is needed to correct it." Gen. James Doolittle, first President of the Air Force Association, deplored the *Nevada* miss and, while crediting the Navy with overall fairness, he observed that "there was something fishy about those first reports that no damage had been done."

The President's Evaluation Commission concluded after Baker that the tests would point the way to changes in ship design, but there was no real protection from the A-bomb except distance:

... future wars employing atomic bombs may well destroy nations and change present standards of civilization. To us who have witnessed the devastating effects of these tests, it is evident that if there is to be any security or safety in the world, war must be eliminated as a means of settling differences among nations.

Even this received little attention. After all the forecasts of doom, hadn't "Pig 311" survived the blast and been found swimming in the lagoon several hours later? Wrote William Laurence: "Mr. Average Citizen felt it was a problem concerning the military and nothing for him to be worried about."

Despite the nuclear-effects data collected, the AAF, Navy, and weapon designers seemed not to learn much either. The Navy feared the tests would be *overrated*. Admiral Blandy said later that many people thought Crossroads would establish the Navy's obsolescence, but "no peacetime test of any kind could be capa-



The ruggedly built aircraft carrier *Saratoga*, anchored more than 500 feet from Zeropoint, finally sank seven and a half hours after the Baker shot.

ble of such proof." Construction on the battleship *Kentucky* and battle cruiser *Hawaii* was halted in September "pending design changes," but this concession to the A-bomb was about as far as anyone in the Navy would go in 1946.

Operation Crossroads settled no strategic questions. The two Crossroads test bombs—however well photographed—provided no better motivation for world peace than had already been offered by World Wars I and II. Even they did not bring international amity and peace. They did not even serve any deterrent role. Stalin ignored the tests and proceeded, undiverted, with his opposition to the Baruch Plan for control of atomic energy, his pressures in Europe, and, of course, his own A-bomb project.

What Crossroads *did* do for America was more subtle. It served as a catalyst in military thinking. As recalled by now-retired USAF Gen. Roscoe C. Wilson, most officers earlier "did not appreciate the nature—or even the blast power—of the A-bomb. I noted no further difficulty [after Crossroads] in convincing anyone of its effectiveness."

Crossroads also helped build the remarkable public support of airpower that emerged during 1947–48 and lasted a full ten years. Within a very few years, this catalytic action resulted in the A-bomb's virtually complete adoption by America's military, in far less time than any new weapon had ever before been accepted by any nation in history.

There is no known estimate of the cost of Crossroads. It must have been close to a half-billion 1946 dollars, not counting the value of the target ships. What the US destiny would have been *without* the tests is—like all of history's unborn possibilities—unanswerable. Thus, it will never be known if the Bikini operations cost too much. But since Able and Baker, there have been twenty-five years of successful nuclear deterrence and American security.

Operation Crossroads was a significant chapter in this development. There is no question about that. ■

The past is prologue... and a lot of fun!

Tat-tat, tat-tat-tat. The bright red Fokker triplane sweeps in low over the aerodrome on a strafing run. Fire is returned from a sandbagged gun emplacement on the field's perimeter. A bomb explodes, billowing smoke. Downfield, a French Nieuport hurriedly takes off in pursuit.

The reenactment of a World War I aerial combat? Exactly.

The grass strip, its hangars, and marvelous aircraft ranging from the Sopwith Camel to Stearman biplane trainers are located near Bealeton, Va., about an hour's drive from Washington, D.C. (see April '71 issue, p. 17).

Called the Flying Circus Aerodrome, the affair is the work of a group of airline pilots and other professionals who "want to preserve the glamour and events of early aviation when pioneer pilots flew stick-and-wire crates to build the modern-day world of jet air transportation." Their goal "is to build a permanent, living history of aviation, a popular rendezvous for tail-dragger pilots of the US."

To help in their effort, the group plans to stage a pageant at the aerodrome each Sunday through October 3. The facilities will be open as an aerial museum weekdays and Saturdays. Events planned for the Sunday spectacles include dogfights, flybys, aerobatics, parachuting, and other aerial and ground activities.

To cover costs, the Flying Circus charges a modest fee for admittance, with reduced rates for picnic and other groups. A refreshment stand is in operation.

—WILLIAM P. SCHLITZ



The Red Baron is long gone, but a replica of his Fokker Dreidecker recalls the infancy of warplanes.



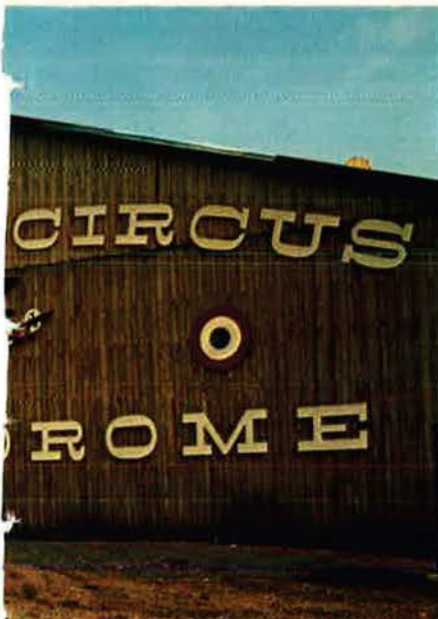
Helmet, goggles, and white scarf—the trappings of a long-ago era.



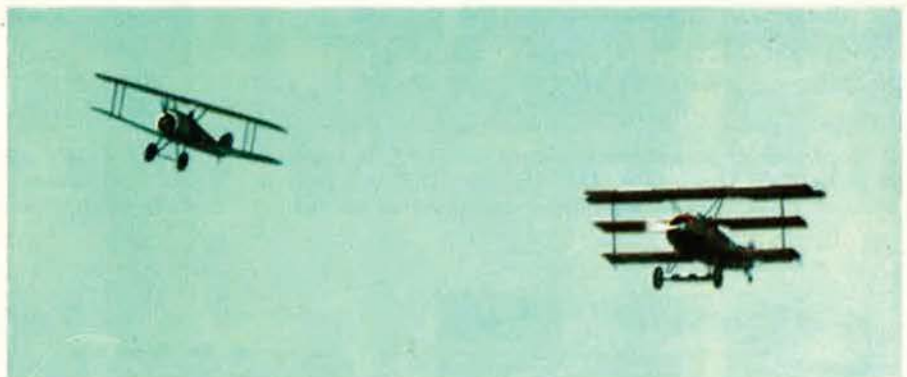
The scarlet triplane roars at full throttle down the grassy runway, ready for another aerial battle.



An aviation enthusiast assumes a devil-may-care stance beside that sentimental favorite—the Sopwith Camel.



On a bright summer's day, the Aerodrome's fleet of colorful Stearmans lines the airstrip.



A French Nieuport and the Fokker triplane maneuver in the Virginia sky for the coming dogfight.

*"It'll never get off the ground," some sneered—
but the stick-and-fabric crate surprised the world.*

Three wars and countless revolutions in technology, organization, and management have marked the constant progress of air logistics from small beginnings to the impressive stature of the Air Force Logistics Command on the eve of another milestone in Air Force history. . .

AFLC's Golden Anniversary

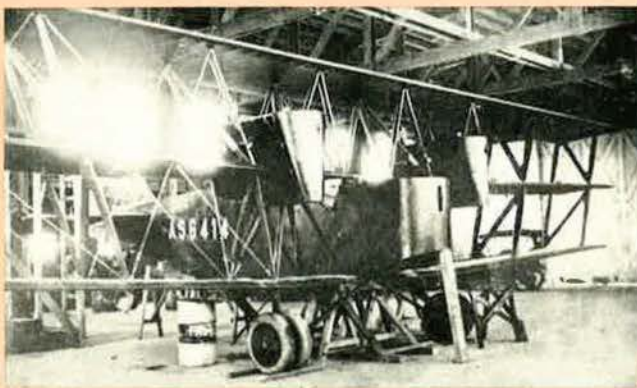


Left, mechanics repair a Liberty-12 engine at Rockwell Air Depot in the late 1920s. Right, a Pratt & Whitney TF33 engine being overhauled at AFLC's Oklahoma City facility. The TF33, used by the B-52H and other USAF aircraft, exceeds the Liberty in power and complexity by orders of magnitude.

On July 14, 1921, the Office of the Chief of the Air Service established at Fairfield Air Intermediate Depot, Fairfield, Ohio, the Office of Property, Maintenance, and Cost Compilation. After many reorganizations, that Office became the Air Force Logistics Command (AFLC), now the oldest command in the Air Force. Fairfield Depot has grown to be Wright-Patterson AFB. AFLC, now commanded by Gen. Jack G. Merrell and still headquartered at the site of its birth, today is responsible for worldwide logistical support of the USAF and of certain allied air forces.

These pictures are symbolic of AFLC's half century of growth in both size and technical sophistication. The command has been recognized as one of the most efficient organizations in the world. And US aerospace power, which AFLC exists to support, has become free society's principal shield against aggression.

The Air Force Association extends to the men and women of the Air Force Logistics Command congratulations on fifty years of remarkable achievement. ■



An experimental ground-attack aircraft, the GAX, in overhaul at Kelly Field, Tex., July 1921. The first GAX was built at McCook Field. Subsequently, Boeing manufactured ten GA-1s.



Nearly a half century later, a B-52 undergoes maintenance and modification in the world's largest maintenance hangar at Kelly AFB. A simple craft had become a complex science.



Left, Sacramento Air Depot just prior to the base dedication ceremony in April 1939. Three decades later, McClellan AFB, Calif., home of the Sacramento Air Materiel Area, had expanded into the vast facility at right.



The Bulletin Board

By Patricia R. Muncy

ASSISTANT FOR MILITARY RELATIONS

Councils Hold Joint Meeting

AFA's Air Reserve and Air National Guard Councils met together in late May in Washington, D. C., to make their final recommendations to the Association President prior to the National Convention.

The two groups heard top officials report on current Reserve and Guard activities and outline plans for future programs. In addition to Maj. Gen. Winston P. Wilson, Chief of the National Guard Bureau, both the Director of Air National Guard, Maj. Gen. I. G. Brown, and the chief of Air Force Reserve, Maj. Gen. Homer I. Lewis, appeared before the Councils.

A number of major resolutions were proposed by the two Councils and are being presented to AFA President George Hardy. They encompass such areas as increased grade allocations to ANG and AFR units, relief of the Air Reserve Technician ceiling, retention of C-124 aircraft, a separate budget for the Air Force Reserve, and restoration of printing funds for *The Air Reservist* magazine. In addition, they called for a study to determine



Maj. Gen. "Pete" Lewis, chief of AFRes, right, leads a discussion at a meeting of AFA's Air Reserve and Air Guard Councils. Looking on are Council Chairmen Maj. Gen. Robert E. L. Eaton, USAF (Ret.), left, and Maj. Gen. Benjamin J. Webster.

the feasibility of the use of aircraft leased from civilian airlines for Reserve component airlift purposes, and a proposal to encourage participation in the Reserve components by granting two years of accredited affiliation with minimal obligation.

Other resolutions called for increased flying hours for AFR Associate units; a change in official inspection criteria of major and specified commands to include a determination of the support of Reserve component units by active-duty organizations; more active support of the AFJROTC program by local Guard and Reserve units and AFA Chapters; and the withdrawal of ROTC programs from any college or university that does not allow academic credit for participation in the program.

The two groups urged AFA to support legislation that would provide Federal Civil Service retirement credit to technicians who have previously served as such in one of the two components, and requested that the Association call upon all public officials and community leaders to encourage participation in the Reserve components, as well as make an all-out effort to stimulate greater support of Guardsmen and Reservists by industrial organizations.

Survivor Benefits

On May 11, AFA's Assistant Executive Director, John O. Gray, appeared before the Interagency Committee to Study Uniformed Services Retirement and Survivor Benefits in further support of the Association's strong endorsement of recomputation of retired pay, improved survivor



W. James Abernethy has been appointed Director of Civilian Personnel for the USAF, succeeding John A. Watts who retired June 1. Formerly employed at Hq. USAF, Mr. Abernethy has served as OSD Director of Personnel since 1966.



Maj. Gen. Thomas H. Crouch, Deputy Air Force Surgeon General, was guest speaker at the May meeting of AFA's Medical Advisory Council. His remarks centered on the CHAMPUS program as it pertains to Air Force people.

The Bulletin Board

benefits, disability benefits, and early retirement on a reduced annuity basis for members of the Reserve components. (See "The Bulletin Board," June '71 issue, p. 78.)

Two weeks after the Interagency hearings, DoD sent to Chairman F. Edward Hébert of the House Armed Services Committee its comments on H.R. 984, survivor benefits legislation, commonly known as the Pike-Gubser Bill. The report was forwarded by Assistant Secretary of Defense (Manpower and Reserve Affairs) Roger T. Kelley, who stated:

"... I am authorized to present this report as the Administration position on this subject. It has been carefully

reviewed, and is concurred in by the Interagency Committee on Uniformed Services Retirement and Survivor Benefits of which I am chairman. . . . I have also been advised by the Office of Management and Budget that passage of the substitute legislation would be consistent with the Administration's objectives."

DoD's position closely parallels the provisions of H.R. 984, with the differences generally being more liberal and, they state, based upon true comparability between military and civilian federal service, with modifications recommended to take into account the differences in conditions of service. "The physical requirements and the up-or-out practices used to ensure retention of a relatively small number of military personnel for the available assignments," the report notes, "mean that only a select few can be retained beyond thirty years of service."

"Military careers are normally completed more than a decade earlier than the careers of federal civilian em-

ployees," the report states. "This means that the typical military member retires at a relatively young age, with a young wife, and with minor children."

Modifications of H.R. 984 recommended by DoD include integration of only one-half of military-earned Social Security survivor benefits with the military survivor benefits for the widow at age sixty-two, as opposed to the Pike-Gubser Bill's full amount; doing away with the provision that would permit attachment of retired pay in certain cases; and permitting a retiree to discontinue coverage upon loss of the beneficiary prior to age fifty, after which age the military and Civil Service retiree characteristics are sufficiently similar to come under the same general rules.

Medical Council Report

Another of the Association's advisory bodies to meet formally during the month of May was the Medical

Senior Staff Changes

B/G James A. Bailey, from Asst. DCS/Comptroller, to DCS/Comptroller, Hq. AFLC, Wright-Patterson AFB, Ohio, replacing **M/G Joseph R. DeLuca** . . . **M/G John H. Bell**, from Cmdr., 3d AF, USAFE, South Ruislip AS, England, to Chief, MAAG, Italy, Rome . . . **M/G Joseph H. Belsler**, from Chief, Western Hemisphere Div., J-5, Jt. Staff, OJCS, to DCS/Plans, Hq. ADC, Ent AFB, Colo., replacing **M/G Jimmy J. Jumper** . . . **Mr. William P. Bethke**, from Dir. of Engineering, to Dir., Information Sciences Div., Rome Air Dev. Ctr., Griffiss AFB, N. Y. . . . **B/G Wendell L. Bevan, Jr.**, from Chief, Rqmts. & Dev. Div., J-5, Jt. Staff, OJCS, to Dir., Special Projects, Central Control Group, Hq. USAF, replacing **B/G Harold F. Knowles** . . . **Col. (B/G Selectee) William C. Burrows**, from Dep. Asst., Nat'l Security Council Matters, DCS/P&O, Hq. USAF, to Chief, Far East Div., J-5, Jt. Staff, OJCS, replacing **B/G (M/G Selectee) Foster L. Smith**.

B/G Robert L. Cardenas, from US DCS/Live Oak, SHAPE, Casteau, Belgium, to Chief, Nat'l Strategic Target List Div., Jt. Strategic Target Planning Staff, Hq. SAC, Offutt AFB, Neb., replacing **M/G John S. Samuel** . . . **B/G Geoffrey G. Cheadle, Carson, Jr.**, from DCS/TTC, Hq. ATC, Randolph AFB, Tex., to Cmdr., Lackland Mil. Tng. Ctr., ATC, Lackland AFB, Tex., replacing **M/G John S. Samuel** . . . **B/G Geoffrey G. Cheadle**, from Asst. C/S, J-6, USMACV, Saigon, Vietnam, to Asst. C/S, Comm-Electronics, PACAF, Camp Smith, Hawaii . . . **Gen. Lucius D. Clay, Jr.**, from Dep. Cmdr., MACV for Air Ops, PACOM, and Cmdr., 7th AF, PACAF, Tan Son Nhut AF, Vietnam, to CinC, PACAF, Hickam AFB, Hawaii, replacing retiring **Gen. Joseph J. Nazzaro** . . . **Dr. Carlo P. Crocetti**, from Senior Scientist (Display Techniques), Engineering Div., to Tech. Dir., Information Sciences Div., Rome Air Dev. Ctr., AFSC, Griffiss AFB, N.Y.

M/G Joseph R. DeLuca, from DCS/Comptroller, Hq. AFLC, Wright-Patterson AFB, Ohio, to Dir. of Budget, AF Comptroller, Hq. USAF, replacing **M/G William F. Pitts** . . . **M/G Rexford H. Dettre, Jr.**, from Asst. C/S, Plans, USMACV, Saigon, Vietnam, to Dep. Dir., J-5, Jt. Staff, OJCS . . . **Col. (B/G Selectee) Robert L. Edge**, from DCS/Plans and Pro-

grams, Hq. AFCS, Richards-Gebaur AFB, Mo., to Dep. Dir., Cmd. Control & Communications, DCS/P&R, Hq. USAF, replacing **B/G (M/G Selectee) Lee M. Paschall** . . . **Col. (B/G Selectee) Lincoln D. Faurer**, from Cmdr., 71st Missile Warning Wg., ADC, McGuire AFB, N.J., to Dir., J-2, USAFSSO, Quarry Heights, Canal Zone, replacing **B/G Erwin A. Hesse** . . . **M/G Dudley E. Faver**, from Cmdr., TUSLOG, USAFE, Ankara, Turkey, to Dir., SAF Personnel Council, OSAF, Hq. USAF.

Col. (B/G Selectee) Lawrence J. Fleming, from Asst. DCS/Ops, Hq. ADC, Ent AFB, Colo., to Cmdr., Air Def. Weapons Ctr., ADC, Tyndall AFB, Fla., replacing **B/G James L. Price** . . . **Col. (B/G Selectee) Herbert J. Gavin**, from Cmdr., 474th TFW, TAC, Nellis AFB, Nev., to Asst. DCS/M, Hq. TAC, Langley AFB, Va. . . . **M/G Robert N. Ginsburgh**, from Cmdr., ASI, AU, Maxwell AFB, Ala., to Chief, Office of AF History, Washington, D.C. . . . **M/G William S. Harrell**, from DCS/M, Hq. ADC, Ent AFB, Colo., to Cmdr., 24th NORAD/CONAD Rgn., w/add'l duty as Cmdr., 24th Air Div., Malmstrom AFB, Mont. . . . **B/G Richard J. Hartman**, from Dep. Dir., Jt. Continental Defense Systems Integration Planning Staff, OJCS, to Chief, Western Hemisphere Div., J-5, Jt. Staff, OJCS, replacing **M/G Joseph H. Belsler**.

B/G Erwin A. Hesse, from Dir., J-2, USAFSSO, Quarry Heights, Canal Zone, to V/C, USAFSS, Kelly AFB, Tex., replacing **B/G George K. Sykes** . . . **B/G (M/G Selectee) James E. Hill**, from Cmdr., 42d Air Div., SAC, Blytheville AFB, Ark., to Dep. Asst. to the Sec. of Def. (Atomic Energy), OSD . . . **B/G John R. Hinton, Jr.**, from Cmdr., 307th Strategic Wg., SAC, U-Tapao Airfield, Thailand, to C/S, 15th AF, SAC, March AFB, Calif. . . . **Col. (B/G Selectee) Hubert O. Johnson, Jr.**, from DCS/Civil Engineering, USAFE, Lindsey AS, Germany, to DCS/Civil Engineering, Hq. AFLC, Wright-Patterson AFB, Ohio, replacing **B/G Billie J. McGarvey** . . . **M/G Jimmy J. Jumper**, from DCS/Plans, Hq. ADC, Ent AFB, Colo., to Asst. C/S, Plans, USMACV, Saigon, Vietnam, replacing **M/G Rexford H. Dettre, Jr.** . . . **B/G Harold F. Knowles**, from Dir., Special Projects, Central Control Group,

Advisory Council. The Council is chaired by Dr. David Waxman of the University of Kansas Medical Center, a brigadier general in the Air Force Reserve.

In addition to a comprehensive report from the Secretary of the Air Force's Office of Legislative Liaison, the Council members were briefed on the major problem areas for the Medical Services during the transition to an all-volunteer military force, and the effectiveness of CHAMPUS (Civilian Health and Medical Program of the Uniformed Services) by representatives of the Air Force Surgeon General; and the difficulties confronting existing medical schools in this country, from both a financial and operational standpoint. The latter presentation was made by Dr. John L. Parks, Dean of the George Washington University Medical Center, Washington, D. C.

Executive actions taken by the Council included reaffirmation of support of Association resolutions on the

dependents' dental care program; recruitment of nonprior service physicians for the Reserve components; the Uniformed Services University of the Health Sciences (formerly referred to as the Armed Forces Medical Academy); comparable promotion opportunities for officers of the Medical Services; medical benefits for Reservists and Guardsmen; and early retirement for members of the Reserve components on a reduced annuity basis.

The Council urged AFA to support a number of legislative actions currently before the Congress, including Senate Bill 1317, which would establish an Armed Forces Health Professions Scholarship Program. Enactment of this bill would help ensure an adequate number of commissioned officers on active duty who qualify in the various health professions required to provide proper medical services for the armed forces. Supporters of the legislation contemplate such a program would be partially successful if it

resulted in a significant improvement in the number of commissioned officers in the health professions who serve on active duty beyond two years. They would consider it completely successful should it result in a retention rate, upon completion of obligated service, of at least ten percent of those who participate.

Several major resolutions were proposed by the Council and have been furnished to the Association President. In addition to urging strong support for a proposed Physicians' Assistants Program, the resolutions call for expansion of federal subsidies to existing medical schools, greater physician promotional opportunities to General Officer rank, and statutory General Officer slots for the senior medical officers of the Air Force Reserve and Air National Guard.

Further, the Council recommended the Association support legislation to improve CHAMPUS coverage for military retirees and their dependents, thereby equalizing benefits under the

Hq. USAF, to Dep. Dir., J-3 (NMCC), Jt. Staff, OJCS, replacing B/G Edward O. Martin.

L/G (Gen. Selectee) John D. Lavelle, from Vice CinC, Hq. PACAF, Hickam AFB, Hawaii, to Dep. Cmdr., MACV for Air Ops, PACOM, and Cmdr., 7th AF, PACAF, Tan Son Nhut AF, Vietnam, replacing Gen. Lucius D. Clay, Jr. . . . **M/G Winton W. Marshall**, from Dir., J-5, US EUCOM, Vaihingen, Germany, to V/C, 7th AF, PACAF, Tan Son Nhut AF, Vietnam . . . **B/G Edward O. Martin**, from Dep. Dir., J-3 (NMCC), Jt. Staff, OJCS, to Cmdr., 42d Air Div., SAC, McCoy AFB, Fla., replacing B/G Woodrow A. Abbott . . . **M/G William R. MacDonald**, from Chief, Nat'l Strategic Target List Div., Jt. Strategic Target Planning Staff, Hq. SAC, Offutt AFB, Neb., to Dir., J-5, US Strike Cmd., MacDill AFB, Fla. . . . **B/G Billie J. McGarvey**, from DCS/Civil Engineering, Hq. AFLC, Wright-Patterson AFB, Ohio, to DCS/Civil Engineering, PACAF, Hickam AFB, Hawaii . . . **Mr. Paul B. McKee**, from Systems Engineering Dir., (F-15), Dep. for Engineering, to System Engineering Dir. (International Fighter), ASD, AFSC, Wright-Patterson AFB, Ohio.

L/G (Gen. Selectee) Theodore R. Milton, from Dep. Chairman, NATO Military Committee, to US Rep., NATO Military Committee . . . **B/G Thomas W. Morgan**, from Manager, Apollo and Skylab Programs, NASA, Kennedy Space Ctr., Fla., to V/C, SAMSO, AFSC, Los Angeles AFS, Calif. . . . **Mr. Joseph J. Naresky**, from Tech. Dir. (Engineering), to Dir., Reliability and Compatibility Div., Rome Air Dev. Ctr., AFSC, Griffiss AFB, N.Y. . . . **B/G Lewis S. Norman, Jr.**, from Cmdr., AF Satellite Control Facility, AFSC, Los Angeles, Calif., to Dep. Dir., Programs, Def. Communications Agency, Arlington, Va., replacing B/G Floyd H. Trogdon . . . **B/G Russell G. Ogan**, from V/C, 14th Aerospace Force, Hq. ADC, Ent AFB, Colo., to Dep. Dir., Personnel Planning, DCS/P, Hq. USAF . . . **L/G Timothy F. O'Keefe**, from Dir., J-4, Jt. Staff, OJCS, Hq. USAF, to Vice CinC, PACAF, Hickam AFB, Hawaii, replacing L/G (Gen. Selectee) John D. Lavelle.

B/G (M/G Selectee) Lee M. Paschall, from Dep. Dir., to Dir., Cmd. Control & Communications, DCS/P&R, Hq. USAF, replacing M/G Gordon T. Gould, Jr. . . . **M/G William F. Pitts**, from Dir. of Budget, AF Comptroller, Hq. USAF, to Cmdr., 3d AF, USAF, South Ruislip AS, England, replacing M/G John H. Bell . . . **B/G James L. Price**, from Cmdr., Air Def. Weapons Ctr., ADC, Tyndall AFB, Fla., to DCS/M, Hq. ADC, Ent AFB, Colo., replacing M/G William S. Harrell . . . **Mr. Frederick T. Rall, Jr.**, from Systems Dev.

Engineer, Dep. for Engineering, to Systems Engineering Dir. (F-15), ASD, AFSC, Wright-Patterson AFB, Ohio, replacing Mr. Paul B. McKee . . . **Mr. Frank L. Roe, Jr.**, from Tech. Dir., Nat'l Range Div., Dep. for Range Systems Management, AFSC, to Tech. Dir., Directorate of Test, DCS Ops, Washington, D.C.

M/G Felix M. Rogers, from Senior Member, UN Cmd., Military Armistice Commission, Korea, to DCS/Tech. Tng., Hq. ATC, Randolph AFB, Tex. . . . **Col. (B/G Selectee) Evan W. Rosencrans**, from Cmdr., 354th TFW, TAC, Myrtle Beach AFB, S.C., to Dir. of Inspection, Office, IG, Norton AFB, Calif. . . . **B/G Donald H. Ross**, from Cmdr., 347th TFW, PACAF, Yokota AB, Honshu, Japan, to Cmdr., 327th Air Div., PACAF, Taipei AS, Taiwan, and Chief, Air Section, MAAG, Rep. of China, replacing M/G Dewitt R. Searles . . . **M/G John S. Samuel**, from Cmdr., Lackland Mil. Tng. Ctr., ATC, Lackland AFB, Tex., to Cmdr., Lowry TTC, ATC, Lowry AFB, Colo. . . . **Mr. Austin L. Sea**, from System Engineering Dir., (B-1A), Dep. for Engineering, to Engineering Dir. (Subsystems and Equipment), ASD, AFSC, Wright-Patterson AFB, Ohio . . . **M/G Dewitt R. Searles**, from Cmdr., 327th Air Div., PACAF, Taipei AS, Taiwan, and Chief, Air Section, MAAG, Rep. of China, to Dep. Cmdr., 7/13th AF, Udorn Airfield, Thailand.

M/G Louis T. Seith, from Cmdr., USMAC, and Chief, JUSMAG Thailand, to Vice Dir., J-3, Jt. Staff, OJCS . . . **B/G (M/G Selectee) Foster L. Smith**, from Chief, Far East Div., J-5, Jt. Staff, OJCS, to Dir., J-5, US EUCOM, Vaihingen, Germany, replacing M/G Winton W. Marshall . . . **B/G Floyd H. Trogdon**, from Dep. Dir., Programs, Def. Communications Agency, Arlington, Va., to Asst. C/S, J-6, USMACV, Vietnam, replacing B/G Geoffrey G. Cheadle . . . **Dr. Richard L. VanDeusen**, from Research Chemist, GS-15, to P.L. 313 position, Senior Scientist, Polymer Branch, AF Materials Lab., AFSC, Wright-Patterson AFB, Ohio . . . **Dr. Billy E. Welch**, from Dir. (Space Ecology), to Research Dir., Environmental Sciences, USAF School of Aerospace Medicine, AFSC, Brooks AFB, Tex.

PROMOTIONS: To General: John D. Lavelle; Theodore R. Milton. (Air Force Reserves) To be Brigadier General: John H. Grimm; Oscar D. Olson.

RETIREMENTS: M/G Louis E. Coira; B/G Richard N. Cordell; B/G Henry C. Dorris; B/G Arthur W. Holderness, Jr.; Gen. Joseph J. Nazzaro; B/G Charles H. Snider; B/G Eugene A. Stalzer; L/G Robert H. Warren. ■

The Bulletin Board



Col. Donald C. Foster, USAF (Ret.), has been elected Executive Vice President of the Retired Officers Association. A former Director of Information for SAC, his last military assignment was in the Office of Assistant Secretary of Defense (Public Affairs).

program, and call upon the Air Force Academy to increase the number of premed students from three to five percent of its student body.

Briefly Noted

- The Air Force has announced a voluntary navigator recall program, its first recall program for line officers since September 1969. Ex-captains and below are eligible for immediate return to active duty, provided they hold a bachelor's degree and performance records that will allow reasonable opportunity for promotion. Age maximum is thirty, but may be raised by the period of active commissioned service.

- Future E-8 and E-9 promotion selection boards will include NCO members. Previously, each panel consisted of three colonels. Under the new policy, each panel will include two colonels and one chief master sergeant.

- The Retired Officers Association has expanded its no-cost job referral and counseling service to its members by the recent installation of automated equipment. According to the Director of its Employment Clearing House, Col. Kirby B. Vick, USMC (Ret.),

the new equipment enables the Association to offer a speedier response to employers' requirements, better exposure for retirees to employers with good jobs, and additional time to develop an intensive job development program.

- The Veterans Administration, in reminding veterans of the importance of including full name, address, and claim number when contacting it, has pointed out that there are 315,400 individuals named Smith on its rolls. Johnson is the next most populous name, appearing 215,400 times; Williams, 159,160; Jones, 150,520; and Brown, 149,000. Also in the VA file system are some illustrious names that cause additional confusion, such as 1,860 Robert E. Lees; forty-seven Ulysses S. Grants, and 600 George Washingtons.

- One hundred nonrated officer candidates from the ranks of first-term airman who have college degrees will be accepted for Officer Training School entry, January-March 1972, for the first time since July 1969. Since 1969, nonrated applicants from the active-duty enlisted ranks have attended OTS only via the Airman Education and Commissioning Program and Bootstrap Commissioning Program. This new program for first-term enlisted college graduates is a special program, for which applications will be accepted from July 1 through September 30. Future nonrated OTS opportunities are not known.

- The most popular publication issued by the Veterans Administration is its booklet, "Federal Benefits for



Mrs. Jayne Baker Spain is the first woman to serve on the US Civil Service Commission. She is President of Alvey-Ferguson Operations, a Litton Industries affiliate. Since 1966 she has served on the President's Committee on Employment of the Handicapped.

Veterans and Dependents," which is now in its twenty-third edition. It is available for twenty cents from the Superintendent of Documents, US Government Printing Office, Washington, D. C. 20402.

- Another VA note indicates that the number of American veterans hit a high of 28.2 million during the month of May. The VA expects the number of living veterans to continue to increase in the foreseeable future since the military discharge rate has been running over 80,000 a month, and older veterans have been dying at a rate of about 26,000 a month.

- Officers volunteering for and getting Minuteman combat crew assignments now have the opportunity to pursue master's degrees in business administration, economics, and industrial management through the Minuteman Education Program. Lieutenants, captains, and majors may apply regardless of their present career fields, according to the USAF Military Personnel Center. Missile launch control officers' duty schedules provide for participation in the Minuteman Education Program during normal duty hours; normal duty tour is a maximum of four years.

- A home for widows and dependents of deceased Air Force enlisted members came a major step closer to reality in late May when the Internal Revenue Service granted the founding organization tax-exempt status. The home, similar in concept to the Air Force Village, has been a major goal of the Air Force Sergeant's Association, and is supported by the Air Force Association.

A site for the project has not yet been selected. Tax-deductible contributions to this most worthwhile effort should be mailed to: Air Force Enlisted Men's Widows and Dependents Home Foundation, Inc., Box 4044, CMR #1, Bolling AFB, Washington, D. C. 20332.

- Air Force Academy veterinarians are doing their bit to preserve the rapidly diminishing species of golden and bald eagles. When federal game authorities learned of the advancements in the medical treatment of birds made by Lt. Col. David Wise, chief Academy veterinarian, and Col. James C. McIntyre, USAF (Ret.), the former chief veterinarian who now heads the falconry program, they began bringing in injured hawks and owls and later injured eagles. So far, the vets have successfully treated two golden and one bald eagle brought to the Academy with broken wings resulting from gunshot. One other golden eagle evidently had eaten poisoned bait before it was captured, and it eventually died. ■

AFA's 25TH ANNIVERSARY

CONVENTION AND AEROSPACE BRIEFINGS AND DISPLAYS

Washington, D.C.—September 19-20-21-22-23

1946



1971

AFA's 1971 Annual National Convention and Aerospace Briefings and Displays, highlighting AFA's Silver Anniversary, will be held at the Sheraton-Park and Shoreham Hotels, Washington, D.C., September 19-23. All reservation requests for rooms and suites should be sent directly to the Sheraton-Park Hotel or Shoreham Hotel Reservation Office. Be sure to refer to AFA's Annual Convention when making your reservation requests, otherwise your request will not be accepted by the Sheraton-Park or Shoreham Hotels. The Sheraton-Park Hotel's address is: 2600 Woodley Road, N.W., Washington, D.C. 20008; and the Shoreham's address is: 2500 Calvert St., N.W., Washington, D.C. 20008. AFA's National Convention activities will include luncheons for the Secretary of the Air Force and the Air Force Chief of Staff, a Silver Anniversary Reception, and the Air Force Anniversary Reception and Dinner Dance. The National Convention will also feature AFA's Business Sessions, Seminars, and several other activities, including a reception in honor of AFA's Chapter Officers and Official Convention Delegates, the Annual Outstanding Airmen Dinner, and the Chief Executives Buffet Reception.

SCHEDULE OF EVENTS

Sunday, September 19

12:00 NN Registration Desk Open
6:00 PM AFA Opening Ceremonies and Awards

11:30 AM Briefing Participants
Buffet Luncheon
11:45 AM AF Secretary's Reception
12:30 PM AF Secretary's Luncheon
4:00 PM Briefing Participants' Reception
7:00 PM AF Anniversary Reception
8:00 PM AF Anniversary Dinner Dance

Monday, September 20

8:00 AM Registration Desk Open
8:15 AM USAF Memorial Service
9:00 AM 1st AFA Business Session
1:30 PM 2d AFA Business Session
6:30 PM AFA President's Reception for Chapter Officers and Convention Delegates

Thursday, September 23

9:00 AM Briefings and Displays Open
11:30 AM Briefing Participants
Buffet Luncheon
4:00 PM Briefing Participants Reception

Tuesday, September 21

8:00 AM Registration Desk Open
9:00 AM AFA Workshop
9:00 AM Briefings and Displays Open
11:30 AM Briefing Participants
Buffet Luncheon
11:45 AM AF Chief of Staff Reception
12:30 PM AF Chief of Staff Luncheon
2:30 PM Air Force Symposium
6:00 PM AFA's Silver Anniversary Reception

Wednesday, September 22

8:00 AM Registration Desk Open
9:00 AM Briefings and Displays Open
9:30 AM Reserve Seminar

ADVANCE REGISTRATION FORM	
25th ANNUAL AIR FORCE ASSOCIATION CONVENTION & AEROSPACE BRIEFINGS & DISPLAYS	
SEPTEMBER 19-23, 1971	SHERATON-PARK HOTEL WASHINGTON, D.C.
1946	AFA SILVER ANNIVERSARY 1971
Type or print	Reserve the following for me:
NAME _____	
TITLE _____	
AFFILIATION _____	
ADDRESS _____	
CITY, STATE _____	<input type="checkbox"/> Advance Registrations @ \$50.00 per person \$ _____ <input type="checkbox"/> *Current Registrations @ \$60.00 per person \$ _____ <input type="checkbox"/> AF Anniversary Reception & Dinner Dance Tickets @ \$30.00 per person \$ _____ <input type="checkbox"/> Amount Enclosed \$ _____

*Current Registration fee (after Sept. 10): \$60.00

An 'AFA News' Feature

"Many of you . . . will soon take your places on the Air Force team. I have confidence that you will meet—and exceed—the demands of the challenge ahead. . . ."

—Air Force Secretary Robert C. Seamans, Jr., to the . . .

23d Annual Arnold Air Society Conclave

The twenty-third annual Arnold Air Society and sixteenth Angel Flight National Conclave convened at the Diplomat Hotel in Hollywood, Fla., April 14-17, to confer its top awards on an Air Force general, a key congressman, and one of the nation's astronauts.

Lt. Gen. Alvan C. Gillem II, Commander of Air University, keynoted opening ceremonies at the conclave by telling the more than 2,300 Air Force ROTC cadets and Angel Flight members that *people* in the Air Force are performing excellently, but that the "hardware" picture for the



The Paul T. Johns Trophy for outstanding contributions to aeronautics and astronautics is awarded by Arnold Air Society National Commander Philip G. Robinson (left) to AFA President George D. Hardy at AAS's annual National Conclave.



Recipients of top awards at the twenty-third annual Arnold Air Society National Conclave were, from left, Rep. F. Edward Hébert (D-La.); Capt. Edgar Mitchell, USN, of Apollo-14's crew; and Gen. Bruce K. Holloway, Commander in Chief of the Strategic Air Command.

Air Force is grim. He told the college students that the Air Force must make up for inadequacies with quality people. Noting that one of the problems facing the Air Force is "image," General Gillem closed by saying, "It is not just my Air Force—it is yours, too, and the honor of the service will rest on your shoulders."

Featured speaker at the Arnold Air Society luncheon was Secretary of the Air Force Robert C. Seamans, Jr. The Secretary told the future officers, "Complicated systems cannot be developed or operated without high-caliber people with new ideas. The emphasis we put on automation tends to obscure the fact, that, when you get right down to it, the wonder machines coming off our production lines are completely lacking in intelligence. Properly used, they can augment man's skills and abilities. But they are not very useful without man's brain to think and observe and make decisions."

Secretary Seamans concluded his remarks by saying, "Many of you attending the Arnold Air Society Conclave will soon take your places on the Air Force team. From where I stand, I have confidence that you will meet—and exceed—the demands of the challenge ahead."

The awards portion of the luncheon followed the Secretary's speech. The General H. H. Arnold Award, the highest military honor given by the Arnold Air Society, was presented to Gen. Bruce K. Holloway, Commander in Chief of the Strategic Air Command, for outstanding contributions to military aviation and aerospace progress.

Congressman F. Edward Hébert (D-La.), Chairman of the House Armed Services Committee, was presented the General Muir S. Fairchild Award for outstanding contributions to aerospace education. Brig. Gen. Howard T. Markey, USAFR, introduced the Congressman as a true friend of the military and also its severest critic. Hébert praised the students in the audience for their involvement in the ROTC program.

Capt. Edgar Mitchell, USN, representing the Apollo-14 crew, received the John F. Kennedy Award for outstanding contributions to space research and development. In his response, the astronaut told the group that the scientific community "is ecstatic" over the discoveries made during the Apollo-14 flight.

The Eugene M. Zuckert Award, given for outstanding contributions to Air Force professionalism, was presented to Maj. Gen. Kenneth W. Schultz, Deputy for Minuteman, SAMS.

George D. Hardy, President of the Air Force Associ-

ation, was named as recipient of the Paul T. Johns Trophy, a civilian achievement award given annually by the Arnold Air Society.

The final top Arnold Air Society award to be presented at the luncheon went to Capt. Harold O'Donovan, Military Assistance Program's student training officer. The award is presented annually for contributions to the Air Force by a junior officer.

Lt. Gen. Robert J. Dixon, Deputy Chief of Staff for Personnel, Hq. USAF, brought a message to the Conclave from Air Force Chief of Staff Gen. John D. Ryan. General Dixon read the message, which said, "I want each of you to know that we in the Air Force are proud of you. During a period when the ROTC has been subjected to unprecedented criticism, you have stood strong and tall. I know many of you have encountered hostility, disdain, and even physical abuse for your loyalty. At the same time, you have shown great patience, fortitude, and maturity. On behalf of the men and women of the United States Air Force, I salute you."

Lt. Col. Robert Roetcisoender, representing the Air Command and Staff College class of 1971, presented the Air University's Air Command and Staff College Award to Cadet John F. Steve, a student at Syracuse University, signifying his selection as the top AFROTC cadet in the nation.

Gen. Jack J. Catton, Commander of the Military Airlift Command, the featured speaker for the awards banquet, referred to "attitude to serve—perspective—patriotism" as the building blocks for a strong nation and complimented the cadets on their "attitude to serve."

"Many of you are from a campus where the 'I'll-serve' attitude sets you apart. Still you are here, ready to serve your country," he said. "Let me assure you—you're right." General Catton closed his remarks by stating, "Do not ever be discouraged. Be confident, be positive. You have every reason in the world to be, because we have people like you versed in the fundamentals—young people who can place our times in the proper perspective, who do have an attitude to serve, and who are patriots."

Brig. Gen. Daniel "Chappie" James, Jr., Deputy Assistant Secretary of Defense for Public Affairs, who was named as the honorary national commander of the Arnold Air Society for this year, presented an echo from his "most famous speech," saying, "There are a lot of people who are experts on peace and never had to fight for it. . . . Nobody dislikes war more than the warriors—after all, they are the ones who are getting shot at."

The top Arnold Air Society and Angel Flight awards presentation followed, with the Thunderbird Squadron at Oklahoma State University receiving the Maryland Cup as the best Arnold Society Squadron in the nation for



As Outstanding Area Commander, Cadet Norman Flemens (center) of the University of Texas is presented with an Air Force saber by AAS National Commander Phil Robinson. Gen. Jack Catton, head of MAC and principal speaker at the banquet, looks on.



Brig. Gen. B. B. Cassidy, Jr., Commandant of Air Force ROTC, is pictured with 1971's "Little General," Loralee Brumund, a member of the Angel Flight at the University of Wisconsin. The "Little General" serves as the official hostess at Arnold Air Society functions.

Norman Flemens Is New Commander of AAS

During the Arnold Air Society Conclave, the John H. Payne Squadron, from the University of Texas, was elected to be the 1971-72 National Headquarters of AAS. The new National Headquarters staff includes Norman R. Flemens, Commander; Dana M. Spears, Vice Commander; Garrett D. Polhamus, Operations Officer; Jeffrey L. Zickler, Administrative Officer; Clinton E. McNabb, Comptroller; Kim M. McGregor, Information Officer; and Richard G. Phaneuf, Chaplain.

The new National Officers for Angel Flight include Collen Wei, Commander; Linda Beck, Executive; Donna Schwartzman, Operations; Tensi Torres, Administrative; Ellen Gaffney, Comptroller; and Jackie Bees, Information.

the second consecutive year. The Purdue Cup, symbolic of selection as top Angel Flight, was awarded to the Tex May Angel Flight from Arizona State University. The Silver Wings Award, given to the outstanding Angel Flight member, went to Kathryn Ann Baker, a member of the Angel Flight at Texas Tech University. The outstanding Arnold Air Society Area Commander was Norman Flemens of the University of Texas.

Miss Marilyn Link, representing the Link Foundation, presented Cadet Lynn Heward of Brigham Young University a \$1,500 Link Foundation scholarship for advanced study.

In the final ceremony of the Conclave, Loralee Brumund, a student at the University of Wisconsin, was named the 1971 "Little General." As such, she will act as the official hostess for the Society. Brig. Gen. B. B. Cassidy, Jr., Commandant of AFROTC, presented Miss Brumund with a dozen red roses. ■

By Don Steele

AFA AFFAIRS EDITOR

THE GEORGIA STATE ORGANIZATION AND THE SAVANNAH CHAPTER . . .

cited for effective programming in support of the mission of AFA, most recently exemplified by their Second Annual Aerospace Seminar for the AFJROTC cadets in their area.

Seventy members of the Wayne County High School AFJROTC unit participated in the Second Annual Aerospace Seminar, cosponsored by the Georgia AFA, the Savannah Chapter, and the 165th Military Airlift Group of the Georgia Air National Guard.

The two-day program included presentations at Travis Field, Savannah, by Col. William H. Kelly, Georgia AFA President and Base Commander, 165th MAG, on "The Value of the AFJROTC Program" and "Operation POW"; "24,000 Miles to

Vietnam With the Georgia Air National Guard," by Lt. Col. Charles E. Miller, the 165th MAG's Chief of Maintenance; a survival demonstration conducted by TSgt. James Newman, survival technician for the ANG group; an orientation flight aboard a C-124 Globemaster; a tour of the Air Guard facilities; a tour of the Federal Aviation Agency and the US Weather Bureau; and a tour of Savannah.

Other participants in the program included Col. William F. Summerell, Commander of the 165th; Lt. Col. John F. Parker, USAF (Ret.), Aero-

space Education Instructor; Chapter President Jack Berry; CWO George W. Adams; CWO Sanders J. King, Jr.; MSgt. Ennis Hagin; and MSgt. Stanley H. Whonic, Assistant AEI. William B. Chesire, Principal of the Wayne County High School, was a special guest during the program.

Hawaii Chapter—off and flying! AFA's Hawaii Chapter, formerly the Oahu Chapter, is now under the leadership of Gen. Hunter Harris, Jr., USAF (Ret.), former Commander in Chief of the Pacific Air Forces.



TSgt. James E. Newman conducts survival-gear demonstration for AFJROTC cadets from Wayne County High School during a seminar sponsored by Georgia AFA, its Savannah Chapter, and the Air Guard's 165th Military Airlift Group.



At Hawaii Chapter luncheon were, from left, T. V. Jones, head of Northrop; Adm. J. S. McCain, CINCPAC; Gen. H. Harris, Jr., USAF (Ret.), Chapter President; and K. J. Luke, Hawaiian National Bank President.

Col. David L. Thomson, center, an Air Force expert on drug abuse—a problem of growing concern to the military—discusses solutions with Rosalie Mynatt, left, President of AFA's Rocky Mountain Chapter, and Glen Jensen, President of the Utah AFA.





The Hon. Harry Davis, Deputy Undersecretary of the Air Force and recipient of the H. H. Arnold Chapter's "Man of the Year" award, provokes a round of laughter from head table guests, from left, Chapter President John F. Dolan, Chapter Councilman Thomas H. O'Brien, and AFA National President George D. Hardy.

cause there is not as much boredom." Troops who become bored often turn to drugs, but the mission of the Air Force, involving handling of aircraft and other highly technical equipment, keeps men busy, he explained.

"Nevertheless," he said, "the problem is serious and we are vitally concerned." The Air Force just this year established its Drug Abuse Control Team and is pursuing several aggressive programs to attack the drug problem among both military personnel and their dependents, Colonel Thomson said.

One key to the service's program is to encourage individuals who are experimenting with drugs, and who fear they may become addicts, to voluntarily come forward and ask for treatment. The Air Force is making a real effort to rehabilitate these men and provide needed help.

Maj. Gen. Richard M. Hoban,

Col. Campbell Palfrey, Jr., USAF (Ret.), is the Chapter's new Vice President, and Col. Anthony Merritt, USA (Ret.), remains as the Chapter's Treasurer.

The first major Chapter function was a luncheon on April 8 in the Coral Ballroom of the Hilton Hawaiian Village. The principal speaker was Thomas V. Jones, President and Chairman of Northrop Corp. Among the more than 200 distinguished business, education, and aerospace leaders were Adm. John S. McCain, Commander in Chief, Pacific, and a member of AFA's Iron Gate Chapter in New York City; Gen. Joseph J. Nazzaro, Commander in Chief, Pacific Air Forces; and K. J. Luke, President of the Hawaiian National Bank.

The Chapter is now busy on an aerospace project to provide historic aircraft to the Bishop Museum in Honolulu, and plans are under way for a formal ball in September in honor of USAF's twenty-fourth anniversary.

A recent dinner meeting of the Rocky Mountain Chapter featured a presentation on drug abuse by Lt. Col. David L. Thomson, chief of the new Air Staff Drug Abuse Control Team.

Drug abuse in the Air Force is occurring at about the same rate as in civilian life. But the Air Force is having less of a drug problem in Vietnam than other branches of the armed services, according to Colonel Thomson.

"The Air Force is more fortunate than other services in Vietnam be-

Honored at the Front Range Chapter's annual "Staffel" Banquet in Denver, Colo., were, from left, Chapter President Roy Haug; Frank Compton, test pilot and aviation leader; Brig. Gen. Edwin S. Wittbrodt, Commander, Air Force Accounting and Finance Center; and Jack Swigert, Apollo-13 astronaut.



While attending a recent meeting of the H. H. Arnold Memorial Chapter at the Arnold Engineering Development Center, Tennessee AFA President James W. Carter, left, discusses AFA's mission and objectives with, from his left, Eugene Wolf, Peter Trenchi, Jr., and L. T. Glaser, Chapter Secretary-Treasurer, President, and Vice President, respectively.

Air Force Association SILVER ANNIVERSARY MEDALS



struck in
**Solid
Palladium***
and
**Solid
Sterling
Silver**



Lt. Gen. James H. Doolittle (Ret.) examines AFA's 25th Anniversary medallion presented to him during ceremonies commemorating the Silver Anniversary event on February 9, 1971.

A limited edition commemorative medal has been commissioned to honor the Silver Anniversary of the Air Force Association and its dedication to American achievement in the aerospace field.

These serially numbered, deep relief medals and medallions will be struck in solid palladium* and in sterling silver by The International Mint whose master engravers created the personal presentation medals for each Apollo flight crew.

The obverse design of the heavy gauge, jeweler's antique finish medal depicts the Air Force Association wings as interpreted by the well-known medallic designer, Donald Struhar, whose work includes the International Mint "History of

America's Men in Space" and commemorative art for the United States Air Force Academy.

The finely detailed reverse design bearing the legend "Power for Freedom", recreates the World Congress of Flight symbol over an arc of 25 stars.

To insure the limited edition status of this medallic tribute to the Air Force Association, The International Mint will restrict the serially numbered commemorative issues to the following mintages:

SOLID PALLADIUM*	
2½" Medallion	25
39mm Medal	250
SOLID STERLING SILVER	
2½" Medallion	2,500
39mm Medal	10,000

Those wishing to subscribe to all four issues or to both sizes in either palladium or sterling will receive matched serially numbered sets. These sets and the 2½" medallion will be housed in handsome desk-top collector displays. Subscribers to the 39mm medals will receive a specially designed Clear-View holder which allows display of both sides of the medal without requiring its removal.

Subscription details are included in the limited edition subscription form below. Since applications will be handled in strict rotation, may we suggest you act now, so as to ensure acquisition of this unique medallic tribute to the Air Force Association.

* A rare, lustrous, silver-white metal approximately equivalent in value to 24K Gold.

© Air Force Association, 1971

Air Force Association Silver Anniversary Medal

Limited Edition Subscription Application

7/71

Please make check payable to: **Air Force Association**
and mail to: **1750 Pennsylvania Avenue, N.W.**
Washington, D.C. 20006

Please enter my order for the following AFA Silver Anniversary medallic issue(s):

QUANTITY	ITEM	PRICE	EXTENSION
_____	Complete set of four issues	\$1195.	_____
_____	Set(s) of Palladium issues	\$1150.	_____
_____	Set(s) of Sterling Silver issues	\$ 45.	_____
_____	2½" Palladium issue(s)	\$1000.	_____
_____	39mm Palladium issue(s)	\$ 150.	_____
_____	2½" Sterling Silver issue(s)	\$ 35.	_____
_____	39mm Sterling Silver issue(s)	\$ 10.	_____

Washington, D.C. residents,
please add 4% sales tax

TOTAL _____

I understand that all orders will be handled in strict rotation and that my check will be refunded promptly should this edition be over-subscribed.

NOTE: As a convenience to subscribers, The International Mint will embed your medals in clear lucite vertical wedges for use as desk ornaments. Add \$5.00 for each 39mm medal and \$8.00 for each 2½" medallion.

The International Mint, Inc. is a wholly-owned subsidiary of The Robbins Company Medallists since 1892. It is not affiliated with the U.S. Mint or any other government agency.

NAME _____

STREET _____

CITY _____ **STATE** _____ **ZIP CODE** _____

AFA News

Ogden Air Materiel Area Commander and an honored guest at the dinner, told members and guests that he had issued instructions to all his officers to give all-out cooperation to the program. He urged all Air Force parents to be on the lookout for signs of drug abuse among their children and to ask for professional guidance. He said that those who "come forward have my admiration and respect."

"Nobody really knows how to handle the drug problem . . . but the Air Force is willing to borrow from any program or agency which offers promise of success," Colonel Thomson concluded.

The Annual Awards Dinner sponsored by AFA's **H. H. Arnold Chapter** of Bethpage, N.Y., honored **Harry Davis**, Deputy Undersecretary of the Air Force, as the Chapter's "Man of the Year."

Mr. Davis was honored for "outstanding service to the country and the Air Force, for encouraging interest in, and the understanding of aerospace programs, and for supporting activities to strengthen America's Air Force and aerospace potential."

Others honored included **Louis Frank**, Police Commissioner for Nassau County, for "Significant Achievement" by a Chapter member; **Col. W. L. Weitner**, USAF, "Service Award"; and **MSgt. J. H. Simpson** as the Chapter's "Airman of the Year."

AFA President George D. Hardy made brief remarks on AFA's current programs.

Special guests among the more than 350 people present included **Maj. Gen. James Keck**; **Judge John Brosky**, Vice President for AFA's Northeast Region; and **New York AFA President Gerald V. Hasler**.

CROSS COUNTRY . . . More than 100 Dayton-area high school principals and counselors attended the **Wright Memorial Chapter's** third annual Air Force Academy workshop held recently at Wright-Patterson AFB, Ohio.

The workshop, conducted jointly by AFA's Wright Memorial Chapter and the area's Air Force Academy Liaison Officers, is held to assure that all high school principals and guidance counselors understand the Air Force Academy program and needs, thus making them better able to ad-



Alabama Gov. George Wallace, seated, signs State of Alabama Proclamation declaring April 22 as "Air Force Band Day" as, from left, John E. Hall and John H. Haire, Alabama AFA Treasurer and President, respectively, and Tennessee Valley Chapter President Don Diehl look on. The Air Force Band's concert in Huntsville on April 22 was sponsored by the Tennessee Valley Chapter.

vised qualified young men on the admission procedures.

Brig. Gen. E. A. Rafalko, Wright-Patterson AFB, Commander, welcomed the group and related some of his experiences while Director of Athletics at the Academy. **Col. William R. Jarrell, Jr.**, Academy Registrar, was the featured speaker.

Other speakers included **A. C. Naum**, Fairborn-Baker High School, "The Counselor and the Boy"; **Capt. J. P. Landis**, AF Academy Liaison Officer, "How a Boy Should Apply"; **Frank Warbington**, aide to Congress-

man **Clarence J. Brown**, "Source Selection Procedures"; **Col. G. E. Hallas**, Professor of Aerospace Studies at Miami University, "The AFROTC"; and **Cadet Robert L. Gilbert**, "The Air Force Academy." The session concluded with remarks by **Col. O. A. Waggoner**, area Air Force Academy Liaison Officer.

Invitations to attend the workshop are rotated annually among area high schools. Each school is invited to send representatives every three years to keep experienced counselors current, and to inform new counselors as they

Aerospace Historian

the journal of aerospace history and affairs.

AEROSPACE HISTORIAN contains articles, book reviews, museum news, photographs and other features stressing the importance and relevance of the lessons of the past for the present and the future, with emphasis on history of the Air Force.

It is published for the Air Force Historical Foundation by the Kansas State University Endowment Association.

Annual memberships in AFHF:

Students, lieutenants and enlisted

men \$5 (in Canada \$5.50)

Regular membership \$8 (in Canada \$8.50)

Institutional subscription \$10 (in Canada \$11.00)

Life membership \$100 (in Canada \$110)

Address all inquiries to Robin Higham, Editor,

Aerospace Historian

Department of History
Kansas State University
Manhattan, Kansas 66502, USA



Include Your Whole Military Group Life

Low-Cost Protection for your Wife... All of Your Children... Can Be Included in Your AFA Life Insurance Coverage

For only \$12.50 per month, AFA's FAMILY PLAN insures you, your wife and all of your children, regardless of number, between the ages of 6 months and 21 years. Additional children will be insured automatically as they become eligible.

Naturally, basic AFA Military Group Life Insurance is available where no family insurance requirement exists –

at a low premium of \$10 per month, unchanged since the program's inception in 1960 except for **cost reductions** by annual dividends in most years. Family Plan protection can be added later.

However, in today's uncertain world, **total** family insurance in one policy – for only \$2.50 per month more – is protection no Air Force family can afford to be without.

OTHER FACTS ABOUT YOUR POLICY

All certificates are dated and take effect on the last day of the month in which your application for coverage is post-marked. Coverage runs concurrently with AFA membership. AFA Military Group Life Insurance is written in conformity with the insurance Regulations of the District of Columbia.

The insurance will be provided under the group insurance policy issued by United Benefit Life Insurance Company to the Air Force Association. However, National Guard and Reserve members who are permanent residents of Ohio, Texas, Wisconsin, and New Jersey, will not be covered under the group policy, but will be eligible for individual policies providing somewhat similar benefits.

EXCLUSIONS – FOR YOUR PROTECTION

In order to provide maximum coverage at minimum cost for all participants, there are a few exclusions which apply to your coverage. They are:

Death benefits for suicide or death from injuries intentionally self-inflicted while sane or insane shall not be effective until your policy has been in force for twelve months.

The Accidental Death Benefit shall not be effective if death results: (1) From injuries intentionally self-inflicted while sane or insane, or (2) From injuries sustained while committing a felony, or (3) Either directly or indirectly from bodily or mental infirmity or poisoning or asphyxiation from carbon monoxide, or (4) During any period while the policy is in force under the waiver of premium provision of the master policy, or (5) From an aviation accident, military or civilian, in which the insured was acting as pilot or crew member of the aircraft involved.

EQUAL COVERAGE – AT THE SAME LOW PREMIUM – FOR FLYING AND NON-FLYING PERSONNEL

All policyholders are insured for the same basic amounts at the same low premium, whether or not they are on flying status. This eliminates the penalty of lower coverage for the men on flying status whose death is caused (as most are) by illness or ordinary accident. There is one exception* to this provision which is clearly stated below the benefit table on the opposite page.

Family in Air Force Association Insurance Protection

BIG, NEW FAMILY PLAN BENEFITS FOR MEMBERS AND THEIR FAMILIES

Insured's Age	Insured's Basic Coverage*	Extra Accidental Death Benefit*	Optional Coverage For	
			Spouse	Each Child**
20-39	\$20,000	\$12,500	\$6,000	\$2,000
40-44	17,500	12,500	5,250	2,000
45-49	13,700	12,500	4,050	2,000
50-59	10,000	12,500	3,000	2,000
60-64	7,500	12,500	2,250	2,000

* A flat sum of \$15,000 is paid for all deaths which are caused by an aviation accident in which the insured is serving as pilot or crew member of the aircraft involved. In this case, the accidental death benefit does not apply.

** Each child is covered in this amount between the ages of six months and 21 years. Coverage in the amount of \$250 is provided between the ages of 15 days — or upon leaving the hospital, if later — and six months.

UNRESTRICTED, WORLDWIDE COVERAGE AND OTHER VALUABLE BENEFITS MAKE THIS AFA PROGRAM YOUR BEST POSSIBLE PROTECTION!

- No War Clause
- No Hazardous Duty Limitation
- No Geographical Limitation
- \$12,500 Accidental Death Benefit
- Guaranteed Conversion to Permanent Insurance
- Waiver of Premium for Disability
- Full Choice of Settlement Options
- Coverage May Be Retained After Leaving Active Duty

You ARE ELIGIBLE IF YOU ARE ON ACTIVE DUTY WITH THE USAF, OR IN THE AIR FORCE READY RESERVE, OR THE AIR NATIONAL GUARD

APPLICATION FOR AFA MILITARY GROUP LIFE INSURANCE (Underwritten by United of Omaha)

Please indicate below the form of payment you elect:

Name (please print) _____

Home Address _____

State _____ Zip _____

Date of Birth _____ Soc. Sec. Number _____

Beneficiary _____ Relationship _____

Insurance is available only to AFA members who enclose \$10 for annual AFA membership dues (includes subscription (\$9) to AIR FORCE/SPACE DIGEST.)

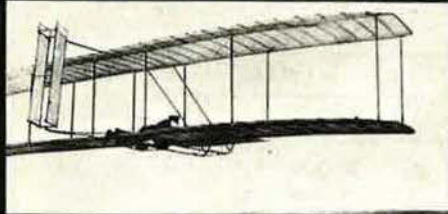
I am an AFA member.

I understand the conditions governing AFA's Group Life Insurance Plan. I certify that I am eligible for this insurance under the category indicated, that I am currently in good health, and that I have successfully passed, within the past two-year period, the last physical examination required by my branch of service. (Reserve and Guard personnel not on extended active duty must include with this application a copy of their most recently completed SF88.) I further understand that if I have requested family coverage, an additional application will be forwarded to me so that members of my family may be included in my policy.

Signature of Applicant _____ Date _____
Application must be accompanied by check or money order. Send remittance to:

INSURANCE DIVISION, AFA 1750 PENNSYLVANIA AVE., N.W., WASHINGTON, D. C. 20006

Let's Keep it Going...



Help teachers and pupils keep informed about air transportation; its importance to the future development of the world, passenger and cargo services, and career opportunities.

IT'S EASY—

Get your organization (PTA, Service Clubs, AFA Chapters, etc.) to donate ten-dollar-a-year memberships in the National Aerospace Education Council to your secondary and elementary school libraries.

Members receive monthly NAEC newsletters, packets of a variety of timely and useful aviation education materials, and assistance with curricular problems. Materials include items developed by teachers for classroom use.

For additional details, write now:

National Aerospace Education Council
Suite 310, 806 15th St., N.W.
Washington, D.C. 20005
(202) 628-7400

A non-profit, professional educational organization

AFA News

are assigned. This year's workshop was arranged and conducted by Chapter President Gerard Kaufhold and Lt. Col. Robert T. Douglass and Maj. Charles Zellner, area Academy Liaison Officers.

President Kaufhold, in discussing the workshop, pointed out its value to area Liaison Officers and counselors, and voiced the hope that other AFA chapters would establish similar programs.

"This year," Mr. Kaufhold said, "we received seventy-nine names of potential cadets at the workshop, and the counselors estimated they could identify as many as 150 more young men who might be interested in an Air Force career."

• The Louisiana AFA and the Shreveport Times recently cosponsored a concert featuring the US Air Force Band and the Singing Sergeants. The groups, under the direction of Col. Arnold D. Gabriel, commander and conductor, performed before a capacity audience in Shreveport's beautiful Civic Theater. Also, a selection of fifty paintings from the Air Force Art Collection was exhibited in the lobby of the theater on the evening of the concert. Louisiana AFA President Toulmin Brown coordinated arrangements for the sponsors.

• AFA's Tucson, Ariz., Chapter and the Tucson Chapter of the Association of the United States Army recently held their second annual joint meeting. This year, members of the two chapters traveled to Fort Huachuca where they witnessed demonstrations of ground sensors and mobile radar equipment used by today's Army. The demonstrations were conducted by personnel of the Army's Combat Surveillance and Electronic Warfare School. Following the demonstrations, members of the two chapters held a joint dinner meeting at the base's Lakeside Officers' Club. AFA Chapter President William P. Chandler and AUSA Chapter President Ed Goyette, who also is a Councilman in the AFA Chapter, arranged the tour and presided at the dinner meeting.

COMING EVENTS . . . Illinois AFA Convention, O'Hare Officers' Club, July 10 . . . AFA's National Convention and Aerospace Development Briefings, Sheraton-Park Hotel, Washington, D. C., September 19-23.

This Is AFA

The Air Force Association is an independent, nonprofit airpower organization with no personal, political, or commercial axes to grind; established January 26, 1946, incorporated February 4, 1946.

Objectives

• The Association provides an organization through which free men may unite to fulfill the responsibilities imposed by the impact of aerospace technology on modern society; to support armed strength adequate to maintain the security and peace of the United States and the free world; to educate themselves and the public at large in the development of adequate aerospace power for the betterment of all mankind; and to help develop friendly relations among free nations, based on respect for the principles of freedom and equal rights for all mankind.

Membership

Active Members: US citizens who support the aims and objectives of the Air Force Association, and who are not on active duty with any branch of the United States armed forces—\$10 per year.

Service Members (nonvoting, nonofficeholding): US citizens on extended active duty with any branch of the United States armed forces—\$10 per year.

Cadet Members (nonvoting, nonofficeholding): US citizens enrolled as Air Force ROTC or JROTC Cadets, Civil Air Patrol Cadets, Officer Trainees, or Cadets of a United States Service Academy—\$5 per year.

Associate Members (nonvoting, nonofficeholding): Non-US citizens who support the aims and objectives of the Air Force Association and whose application for membership meets AFA Constitutional requirements—\$10 per year.

Officers and Directors

GEORGE D. HARDY, President, Hyattsville, Md.; **NATHAN H. MAZER**, Secretary, Roy, Utah; **JACK B. GROSS**, Treasurer, Harrisburg, Pa.; **JESS LARSON**, Chairman of the Board, Washington, D.C.

VICE PRESIDENTS: **Will H. Bergstrom**, Colusa, Calif. (Far West Region); **John G. Brosky**, Pittsburgh, Pa. (Northeast Region); **C. W. Burnette**, Anchorage, Alaska (Northwest Region); **B. L. Cockrell**, San Antonio, Tex. (Southwest Region); **Lester C. Curl**, Melbourne Beach, Fla. (Southeast Region); **Wm. D. Flaskamp**, Minneapolis, Minn. (North Central Region); **Stanley Mayer**, Omaha, Neb. (Midwest Region); **H. John McGaffigan**, Shreveport, La. (South Central Region); **Edward T. Nedder**, Hyde Park, Mass. (New England Region); **Jack Price**, Clearfield, Utah (Rocky Mountain Region); **David M. Spangler**, Danville, Va. (Central East Region); **W. M. Whitney, Jr.**, Detroit, Mich. (Great Lakes Region).

DIRECTORS: **John R. Allison**, Los Angeles, Calif.; **Joseph A. Assaf**, Hyde Park, Mass.; **William R. Berkeley**, Redlands, Calif.; **Milton Caniff**, Palm Springs, Calif.; **M. Lee Cordell**, Berwyn, Ill.; **Edward P. Curtis**, Rochester, N.Y.; **S. Parks Deming**, Colorado Springs, Colo.; **James H. Doolittle**, Los Angeles, Calif.; **A. Paul Fonda**, Washington, D.C.; **Joe Foss**, Scottsdale, Ariz.; **Paul W. Gaillard**, Omaha, Neb.; **Jack T. Gilstrap**, Huntsville, Ala.; **Martin H. Harris**, Winter Park, Fla.; **John P. Henebry**, Kenilworth, Ill.; **Joseph L. Hodges**, South Boston, Va.; **Robert S. Johnson**, Woodbury, N.Y.; **Sam E. Keith, Jr.**, Fort Worth, Tex.; **Arthur F. Kelly**, Los Angeles, Calif.; **George C. Kenney**, New York, N.Y.; **Maxwell A. Kriendler**, New York, N.Y.; **Thomas G. Lanphier, Jr.**, La Jolla, Calif.; **Robert Lawson**, Los Angeles, Calif.; **Curtis E. LeMay**, Newport Beach, Calif.; **Carl J. Long**, Pittsburgh, Pa.; **Howard T. Markey**, Chicago, Ill.; **J. P. McConnell**, Washington, D.C.; **J. B. Montgomery**, Tulsa, Okla.; **Warren B. Murphy**, Boise, Idaho; **Martin M. Ostrow**, Beverly Hills, Calif.; **Dick Palen**, Edina, Minn.; **Julian B. Rosenthal**, New York, N.Y.; **Peter J. Schenk**, Arlington, Va.; **Joe L. Shosid**, Fort Worth, Tex.; **Robert W. Smart**, Washington, D.C.; **C. R. Smith**, Washington, D.C.; **Carl A. Spaatz**, Chevy Chase, Md.; **William W. Spruance**, Wilmington, Del.; **Thos. F. Stack**, San Francisco, Calif.; **Hugh W. Stewart**, Tucson, Ariz.; **Arthur C. Storz**, Omaha, Neb.; **Harold C. Stuart**, Tulsa, Okla.; **James M. Trail**, Boise, Idaho; **Nathan F. Twinling**, Hilton Head Island, S.C.; **Jack Withers**, Dayton, Ohio; **James W. Wright**, Williamsville, N.Y.; **Rev. Robert D. Coward**, National Chaplain, Orlando, Fla. (ex-officio); **Phillip Robinson**, Nat'l Commander, AAS, University of Washington, Seattle, Wash. (ex-officio).

State Contacts

Following each state name, in parentheses, are the names of the localities in which AFA Chapters are located. Information regarding these Chapters, or any place of AFA's activities within the state, may be obtained from the state contact.

ALABAMA (Auburn, Birmingham, Huntsville, Mobile, Montgomery, Selma, Tuscaloosa): **John H. Haire**, 2604 Bonita Circle, Huntsville, Ala. 36111 (phone 465-5499).

ALASKA (Anchorage, Fairbanks, Kenai): **Gordon Wear**, Box 777, Fairbanks, Alaska 99701 (phone 452-4411).

ARIZONA (Phoenix, Tucson): **William F. Barns**, 5409 E. Camello Dr., Phoenix, Ariz. 85108 (phone 267-2357).

ARKANSAS (Blytheville, Fort Smith, Little Rock): **Alex E. Harris**, 3700 Cantrell Rd., Apt. 612, Little Rock, Ark. 72202 (phone 664-1915).

CALIFORNIA (Burbank, Edwards, Fairfield, Fresno, Harbor City, Hawthorne, Long Beach, Los Angeles, Monterey, Novato, Orange County, Palo Alto, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, Santa Barbara, Santa Clara County, Santa Monica, Tahoe City, Vandenberg AFB, Van Nuys, Ventura): **Floyd Damman**, 11055 Candor St., Cerritos, Calif. 91104 (phone 675-4611, ext. 2274).

COLORADO (Boulder, Colorado Springs, Denver, Pueblo): **R. E. Stanley**, 7644 Heath Dr., Colorado Springs, Colo. 80907 (phone 473-3154).

CONNECTICUT (Torrington): **Orrin C. Fritz**, 190 N. Ridge Ave., Torrington, Conn. 06787 (phone 489-7493).

DELAWARE (Wilmington): **Vito A. Panzarino**, Greater Wilmington Airport, Bldg. 1504, Wilmington, Del. 19720 (phone 328-1208).

DISTRICT OF COLUMBIA (Washington, D.C.): **Robert J. Schlssel**, 1700 Pennsylvania Ave., N.W., Suite 500, Washington, D.C. 20006, (phone 223-4430).

FLORIDA (Bartow, Broward, Daytona Beach, Ft. Walton Beach, Gainesville, Homestead, Jacksonville, Miami, Orlando, Panama City, Patrick AFB, Redington Beach, Tallahassee, Tampa): **Daniel F. Callahan**, Deputy Director of Administration, Kennedy Space Center, Fla. 32899 (phone 867-3740).

GEORGIA (Athens, Atlanta, Savannah, St. Simons Island, Valdosta, Warner Robins): **William H. Kelly**, 241 Kensington Dr., Savannah, Ga. 31402 (phone 964-1941).

HAWAII (Honolulu): **Hunter Harris, Jr.**, 2003 Kalia Rd., Honolulu, Hawaii 96815 (phone 949-5941).

IDAHO (Boise, Burley, Pocatello, Twin Falls): **Donald M. Riley**, 6925 Copper Dr., Boise, Idaho 83704 (phone 375-2948).

ILLINOIS (Champaign, Chicago, Elmhurst, Deerfield, O'Hare Field): **M. Lee Cordell**, 1901 Kenilworth Ave., Berwyn, Ill. 60402 (phone 679-8700).

INDIANA (Indianapolis): **Oliver K. Loer**, 268 S. 800 W., Swayzee, Ind. 46986 (phone 922-7136).

IOWA (Cedar Rapids, Des Moines): **Ric Jorgensen**, 4005 Kingsmen, Des Moines, Iowa 50311 (phone 255-7656).

KANSAS (Wichita): **Don C. Ross**, 10 Linwood, Eastborough, Wichita, Kan. 67201 (phone 686-6409).

LOUISIANA (Alexandria, Baton Rouge, Bossier City, Monroe, New Orleans, Ruston, Shreveport): **Ralph F. Chaffee**, 4731 Fern Ave., Shreveport, La. 71105 (phone 865-7084).

MARYLAND (Baltimore): **Henry R. Johnston**, 106 Taplow Rd., Baltimore, Md. 21212 (phone 435-3366).

MASSACHUSETTS (Boston, Falmouth, Florence, Lexington, L. G. Hanscom Fld., Taunton, Worcester): **James Fiske**, 514 Lowell St., Lynnfield Ctr., Mass. 01740 (phone 536-2800).

MICHIGAN (Dearborn, Detroit, Kalamazoo, Lansing, Mount Clemens, Sault Ste. Marie): **Richard W. Hoerle**, 19301 Parke Lane, Grosse Ile., Mich. 48138 (phone 676-5948).

MINNESOTA (Duluth, Minneapolis, St. Paul): **Victor Vacanti**, 8941 10th Ave., Minneapolis, Minn. 55420 (phone 888-4240).

MISSISSIPPI (Biloxi, Jackson): **M. E. Castleman**, 5207 Washington Ave., Gulfport, Miss. 39501 (phone 863-6526).

MISSOURI (Kansas City, Springfield, St. Louis): **Rodney G. Horton**, 4314 N. E. 53d St., Kansas City, Mo. 64119 (phone 452-7834).

NEBRASKA (Lincoln, Omaha): **Lloyd Grimm**, P. O. Box 1477, Omaha, Neb. 68101 (phone 553-1812).

NEVADA (Las Vegas): **Barney Rawlings**, 2617 Mason Ave., Las Vegas, Nev. 89102 (phone 735-5111).

NEW HAMPSHIRE (Pease AFB): **R. L. Devoucoux**, 270 McKinley Rd., Portsmouth, N.H. 03801 (phone 624-4011).

NEW JERSEY (Andover, Atlantic City, Belleville, Chatham, E. Rutherford, Fort Monmouth, Jersey City, McGuire AFB, Newark, Trenton, Wallington, West Orange): **Mamie Kinsley**, 2 Center St., Belleville, N.J. 07109 (phone 751-1582).

NEW MEXICO (Alamogordo, Albuquerque): **Pat Sheehan**, P. O. Box 271, Albuquerque, N.M. 87103 (phone 255-7629).

NEW YORK (Albany, Bethpage, Binghamton, Buffalo, Chautauqua, Elmira, Griffiss AFB, Hartsdale, Ithaca, Long Island, New York City, Patchogue, Plattsburgh, Riverdale, Rochester, Staten Island, Syracuse): **Gerald V. Hasler**, P.O. Box 11, Johnson City, N.Y. 13790 (phone 754-3435).

NORTH CAROLINA (Charlotte, Fayetteville, Goldsboro, Raleigh): **H. Fred Waller, Jr.**, 3706 Melrose Dr., Raleigh, N.C. 27604 (phone 832-6014).

OHIO (Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo, Youngstown): **Ernest E. Pierce**, 143 Woodbury Dr., Dayton, Ohio 45415 (phone 449-2618).

OKLAHOMA (Altus, Enid, Oklahoma City, Tulsa): **Edward McFarland**, Suite 1100, Shell Bldg., Tulsa, Okla. 74119 (phone 583-1877).

OREGON (Corvallis, Portland): **Robert Ringo**, 605 S.W. Jefferson St., Corvallis, Ore. 97330 (phone 753-4482).

PENNSYLVANIA (Beaver Falls, Erie, Homestead, Lewistown, New Cumberland, Philadelphia, Pittsburgh, Washington, Willow Grove): **Robert L. Carr**, 2219 Brownsville Rd., Pittsburgh, Pa. 15210 (phone 884-0400).

RHODE ISLAND (Warwick): **Matthew Puchalski**, c/o 143 SOG RIANG, T.F. Green Airport, Warwick, R.I. 02886 (phone 737-2100, ext. 27).

SOUTH CAROLINA (Charleston, Columbia, Myrtle Beach): **James F. Hackler, Jr.**, Box 2065, Myrtle Beach, S.C. 29577 (phone 449-3331).

SOUTH DAKOTA (Sioux Falls): **Don Hedlund**, 2701 W. 24th St., Sioux Falls, S.D. 57105 (phone 336-1376).

TENNESSEE (Memphis, Nashville, Tullahoma): **James W. Carter**, Williamsburg Rd., Rt. 3, Brentwood, Tenn. 37027 (phone 834-2008).

TEXAS (Abilene, Austin, Big Spring, Corpus Christi, Dallas, Del Rio, El Paso, Fort Worth, Houston, Lubbock, San Angelo, San Antonio, Sherman, Waco, Wichita Falls): **John Allison**, P. O. Box 5116, Waco, Tex. 76708 (phone 754-3318).

UTAH (Brigham City, Clearfield, Ogden, Salt Lake City, Provo): **Glen L. Jensen**, 1293 W. Fifth South, Salt Lake City, Utah 84104 (phone 359-4485).

VERMONT (Burlington): **R. F. Wissinger**, 158th CAM SD, Burlington International Airport, Vt. 05401 (phone 863-4494).

VIRGINIA (Arlington, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Richmond, Roanoke): **Richard C. Emrich**, 6416 Noble Dr., McLean, Va. 22201 (phone 426-3020).

WASHINGTON (Bellevue, Port Angeles, Seattle, Spokane, Tacoma): **Leslie D. Kelsor**, 828 E. 4th, Apt. 101, Port Angeles, Wash. 98362 (phone 457-6571).

WISCONSIN (Madison, Milwaukee): **Lyle W. Ganz**, 1536 N. 69th St., Wauwatosa, Wis. 53213 (phone 444-4442).

WYOMING (Cheyenne): **Conley B. Stroud, Jr.**, 6421 Evers Blvd., Cheyenne, Wyo. 82001 (phone 638-9517).



Bob Stevens'

"There I was..."

For the story of the tests at Bikini's blue atoll, See "Operation Crossroads," by Colonel Kenneth Moll. With the insight of the artist, Bob Stevens here presents Some scenes of human drama from those long-ago even

1946 - TASK FORCE 152 IS EN ROUTE TO BIKINI FOR THE A-BOMB TESTS....AH, BIKINI!

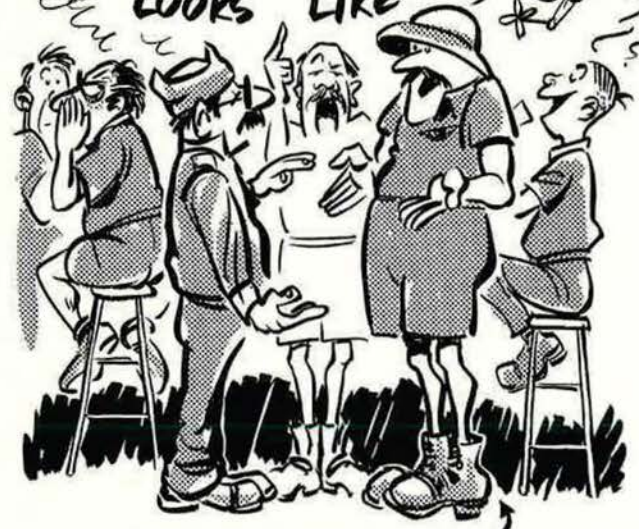


- THEN THEY LANDED!



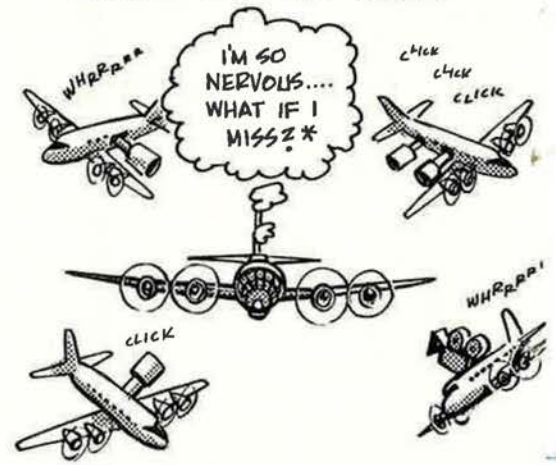
THE MAIN TOPIC AT THE CLUB BARS WAS-

WHAT THE BOMB LOOKS LIKE



KWAJALEIN DRESS: PITH HELMET, SHORTS and BOONDOCKERS (PONCHOS WERE ALSO FASHIONABLE!)

ABLE DAY 1 JULY 1946 - WHILE THOUSANDS WATCHED DAVE'S DREAM - A B-29-DROPPED THE BOMB ON A CAPTIVE TARGET FLEET -



* HE DID! - BUT IN A-BOMB DISTANCES, NOT SO FAR YOU'D NOTICE.

Bob Stevens

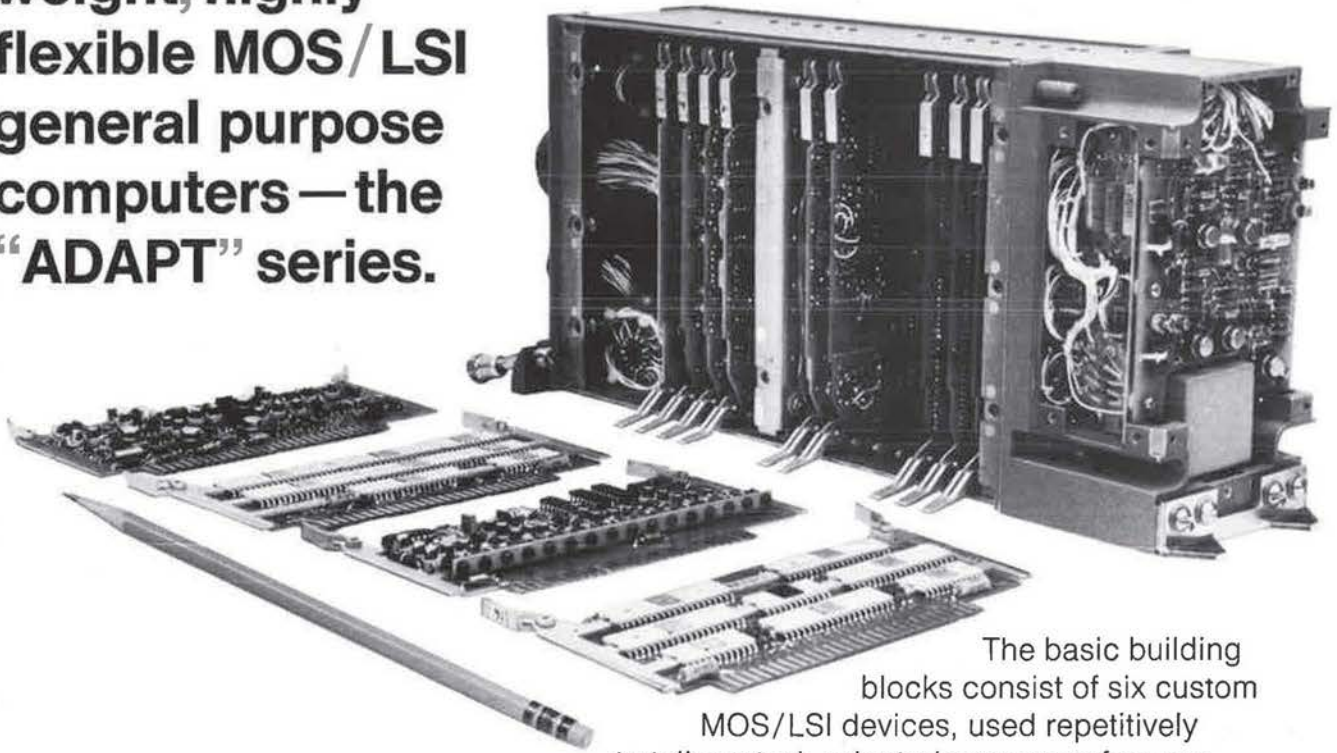
Garrett has a new family of minimum weight, highly flexible MOS/LSI general purpose computers — the "ADAPT" series.

The first application of the "ADAPT" G. P. Computer concept has been the air inlet control system for the Navy's F-14. It meets all the requirements of MIL-E-5400, Class 2 and is in quantity production.

Some of its obvious advantages are the direct result of MOS/LSI technology. Models in the "ADAPT" series weigh as little as 8 pounds, measure 4¼" x 7" x 8", and run on 20 watts of MIL-STD-704 power. At low cost. With high reliability. No cooling is required.

Even more remarkable is the flexibility of the "ADAPT" series, achieved through

- microprogramming
- bus orientation
- the "bit-slice" building block concept.




The basic building blocks consist of six custom MOS/LSI devices, used repetitively to tailor a task-oriented processor for your application with a minimum of non-recurring cost.

Garrett has a family of MOS/LSI general purpose computers; and you can learn more about them with a phone call or letter.

Contact: Sales Manager, Garrett AiResearch Electronic Systems, 2525 West 190th Street, Torrance, California 90509



AiResearch Manufacturing Co.

one of The Signal Companies 

1,000 mi.

2,000 mi.

3,000 mi.

4,000 mi.

5,000 mi.



Three new DC-10s: for routes from 300 to 6,100 miles.

With our wide-cabin DC-10, you get more than a money-maker. You get a choice of aircraft especially suited to your route structure and load patterns.

□ The DC-10 Series 10 can reduce your seat-mile costs below that of present equipment on routes from 300 miles to any distance up to 3,670 miles.

□ Our Series 20 and 30 DC-10s will do the same on intercontinental and over-water routes up to 6,100 miles.

□ Another choice is the DC-10F convertible

freighter with profit potential with either passengers or freight. □ DC-10s can be configured to carry from 270 to 345 passengers. And they'll operate from airports where jumbos fear to tread. □ Talk to the DC-10 team at McDonnell Douglas. Whatever your route structure or schedule pattern, they can help make your choice a lot easier.

MCDONNELL DOUGLAS

